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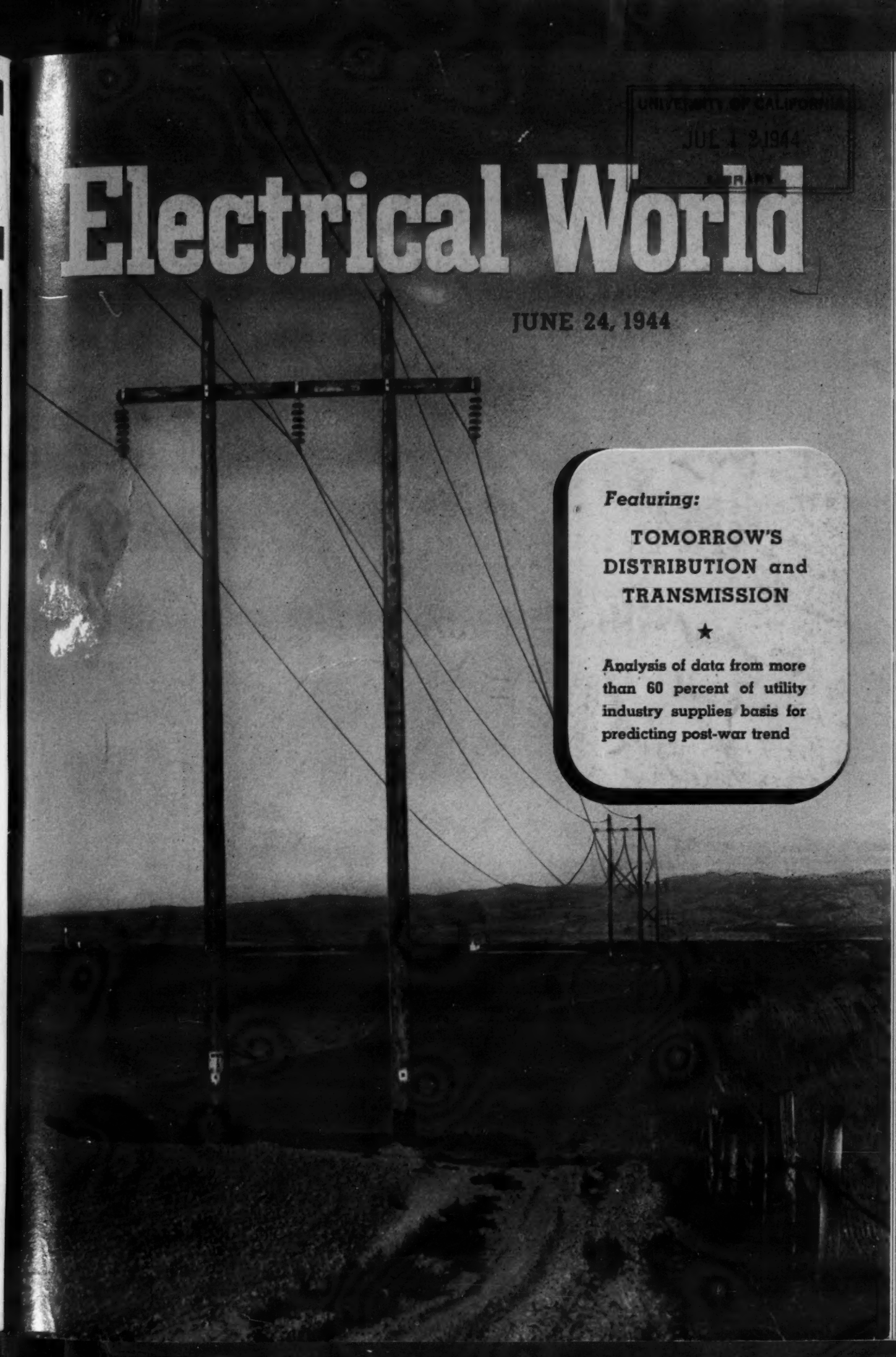
# Electrical World

JUNE 24, 1944



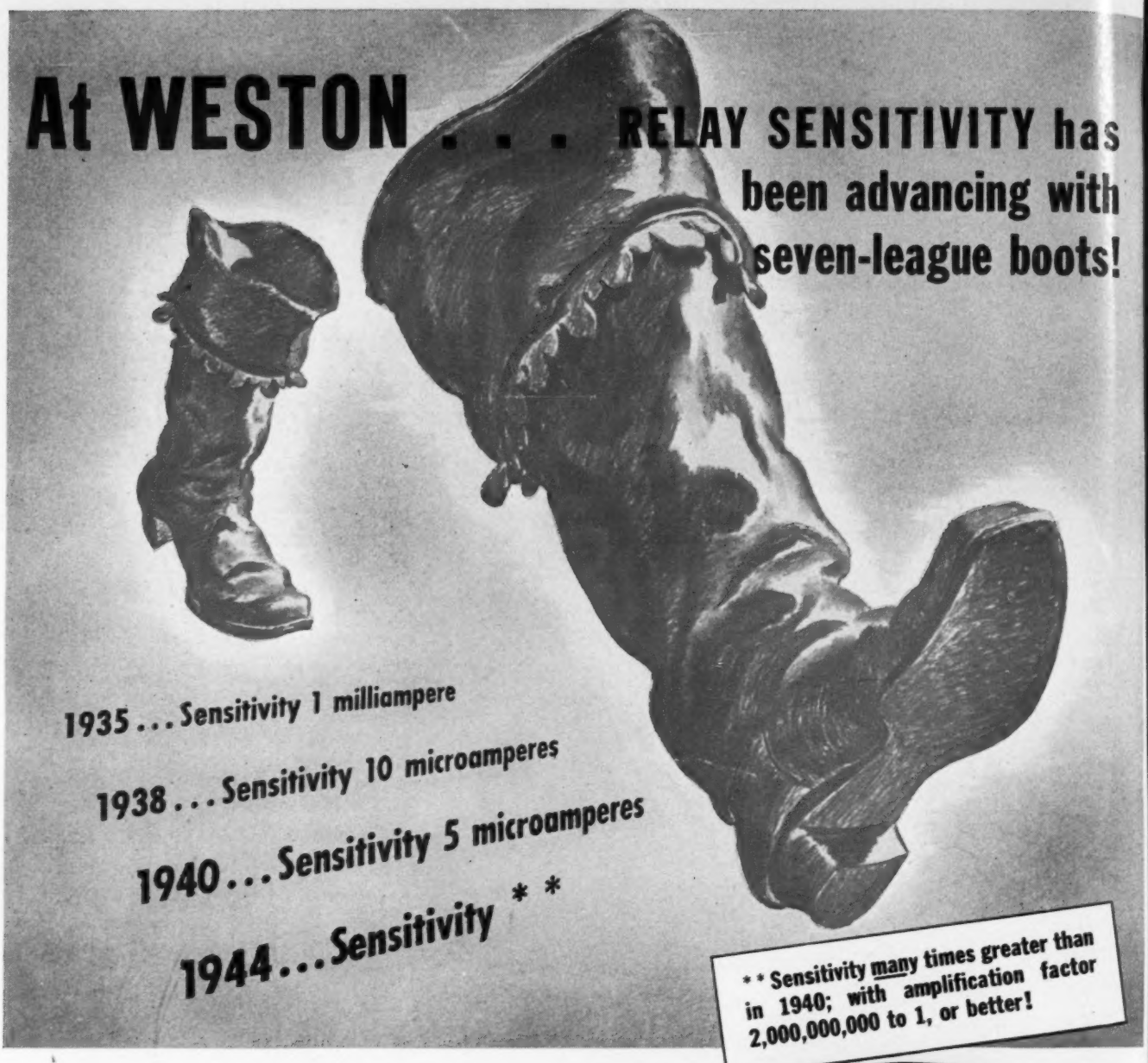
*Featuring:*

**TOMORROW'S DISTRIBUTION and TRANSMISSION**

★

**Analysis of data from more than 60 percent of utility industry supplies basis for predicting post-war trend**

# At WESTON . . . RELAY SENSITIVITY has been advancing with seven-league boots!




** Sensitivity many times greater than in 1940; with amplification factor 2,000,000,000 to 1, or better!

With today's emphasis on electronics, WESTON developments in the field of Sensitive Relays assume utmost interest to design engineers. Even prior to the war, these relays provided positive control at input values low as 2 microamperes or 1 millivolt. Employing WESTONS exclusive *magnetic contact* principle, they handled 5 watts at 110 volts, with complete freedom from contact troubles.

But relay development at WESTON has kept pace with the more exacting *control* needs of this war. Relays with sensitivity *for exceeding* that of pre-war days already have proved their reliability on critical equipment, and under the most rigorous conditions!

More than likely, these relays provide the answer for many of tomorrow's products; for they provide the simplest, most compact means of controlling at minute energy levels.

Have the full story on "what's ahead" in sensitive relays and instruments at your fingertips. Check WESTON, too, on all *war instrument* needs!

Laboratory Standards . . . Precision DC and AC Portables . . . Instrument Transformers . . . Sensitive Relays . . . DC, AC, and Thermo Switchboard and Panel Instruments.

# WESTON

Specialized Test Equipment . . . Light Measurement and Control Devices . . . Exposure Meters . . . Aircraft Instruments . . . Electric Tachometers . . . Dial Thermometers.

FOR OVER 50 YEARS LEADERS IN ELECTRICAL MEASURING INSTRUMENTS

June 24, 1944

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330 West 42nd Street, New York 18, N. Y.
Director of Circulation:

Please change my address on Electrical World

From .....

.....

To .....

.....

Signed .....

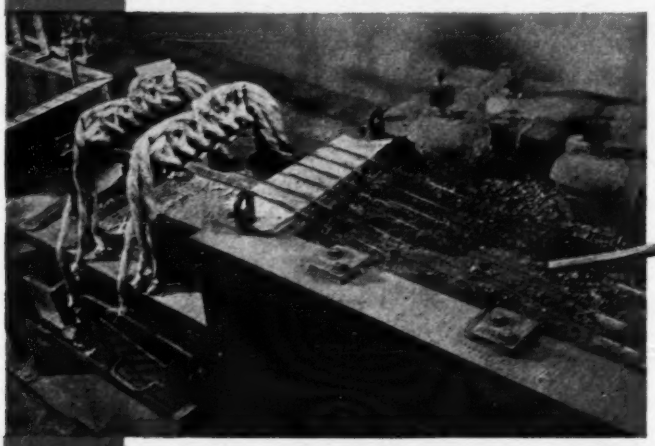
# OKOLOY
## was not drafted . . .
## It volunteered in 1928

The war-caused shortage of tin forced many wire and cable manufacturers to search hurriedly for substitutes to replace the tin coating on conductors to prevent chemical reactions between the copper and rubber insulation.

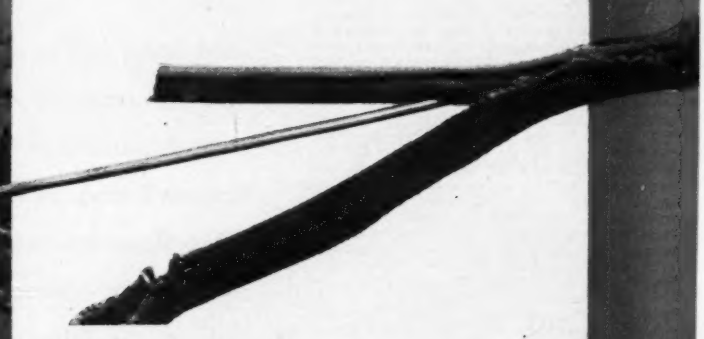
In 1928, however, Okonite chemists, constantly discontent with run-of-the-mill practices, had developed and perfected Okoloy, a lead alloy coating that outlasts tin at least 2 to 1.

The old practice of "tinning" the copper conductors by passage through a bath of molten metal gave inadequate protection and too often led to failure and premature deterioration of expensive cables.

No war-forced substitute, Okoloy, for sixteen years, has been used to protect the copper conductors of all Okonite rubber insulated cables. When you specify any Okonite cable, Okoloy is just one of the "plus benefits" you obtain.



**LASTING PROTECTION:** After electrolytic cleaning, all Okonite copper wire passes through the Okoloy bath where, under carefully controlled temperature, the corrosion-resistant Okoloy coating is bonded to the conductor.



**PROVED IN THE FIELD SINCE 1928:** Section of Okoloy-coated wire removed for examination in 1941 after 13 years of service along right-of-way of a major railroad system, where it was continuously exposed to weather and to highly corrosive sulphur fumes. Note perfect condition of Okoloy coating and Okonite insulation.

THE OKONITE COMPANY, PASSAIC, NEW JERSEY

**OKONITE** INSULATED WIRES & CABLES

LITTLE DID WE KNOW, these 12 years we were saying, "Electroline Automatic Line Splices are reclaimable" that the really big story had not yet been told.

Now this important reclaimable feature scores again. Vital materials from which Automatic Line Splices are made are mostly off to war . . . so it is impossible to supply the quantity of line splices we would like to but your stock bins will supply splices for immediate requirements.

Every "out of service" line equipped with Electroline Automatic Line Splices is a source of supply. These splices are reclaimable.

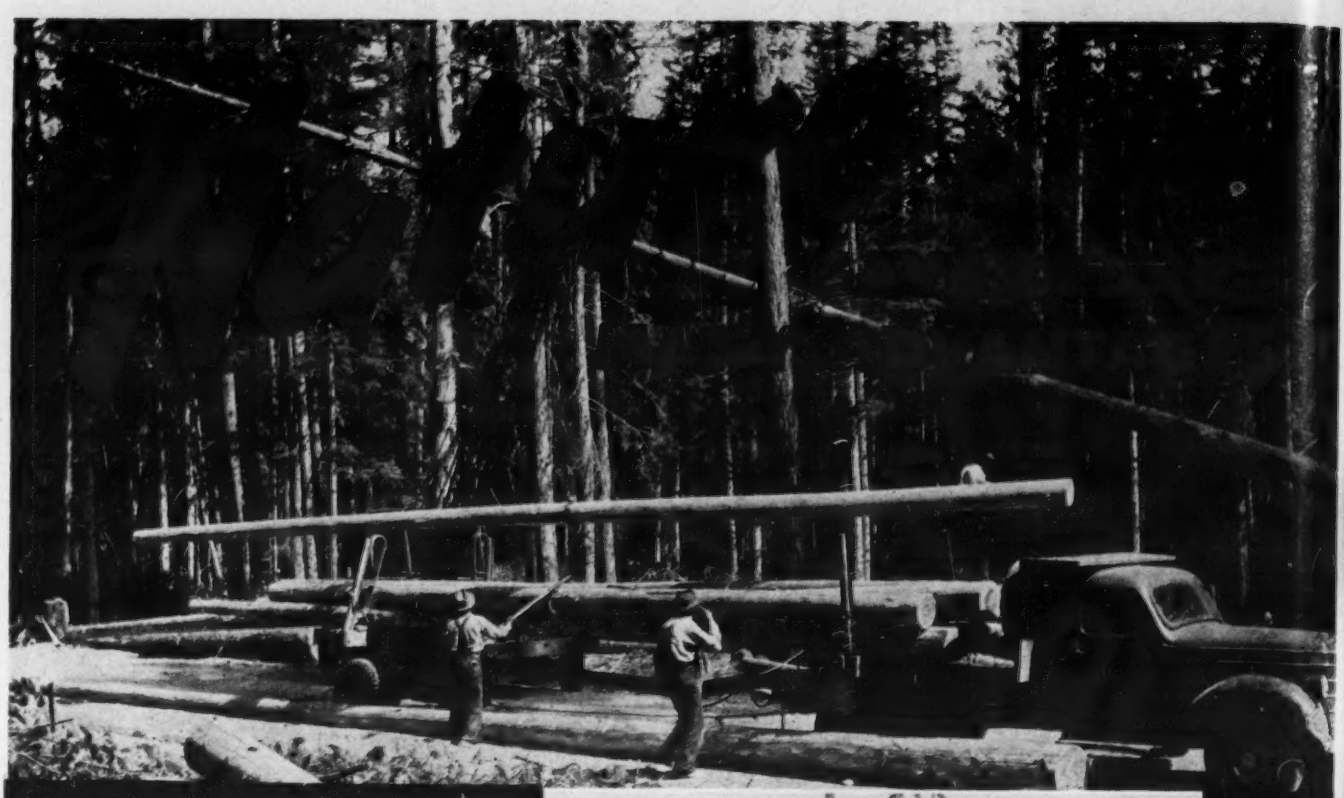
Electroline Splices can be removed in a jiffy. Back they go to stock bins for re-use . . . time and time again. Stock without stock expenditures. How's that for an "extra" dividend?

It is the everlasting quality of Electroline products that assures our users of adequate, effective usable Automatic Line Splices for the duration. The quality is there because long experience in this field has taught us how to put it there. Not only the first Automatic Line Splice, but also the first Reclaimable Line Splice came from the house of Electroline.

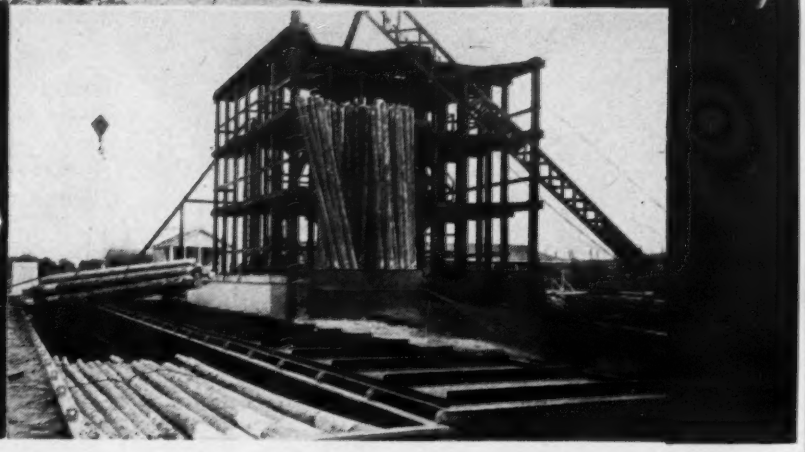
**Electroline Company**

*Originators and Patentees of Automatic Line Splices and Dead Ends*

4121 SOUTH LA SALLE STREET • CHICAGO 9, ILLINOIS



# LIFE-SPAN Adds Another



Life Span

*Sold only by the following*

**SCHAEFER-HITCHCOCK**
Sandpoint, Idaho
Supplier for Joslyn

**NAUGLE POLE & TIE CORP.**
Minneapolis, Minn.

**PAGE AND HILL CO.**
Minneapolis, Minn.
50 Church St., New York, N. Y.

**B. J. CARNEY & CO.**
Spokane Minneapolis

## Decay Resistance from Top to Butt

Going Nature one better isn't always easy! In producing cedar trees, Nature has given us a product unmatched for pole use in straightness, proportion, soundness and native durability. Yet Life-Span scientists actually have succeeded in adding extra years to already long-lived cedar. Through special application of a powerful chlorinated phenol wood preservative, cedar sapwood has been given long-lasting resistance to invasion from fungi and insects. Tests have proved that this protective treatment permeates the entire sapwood! The result is a new standard of pole life and service. Life-Span full-length toxi-tized Cedar Poles cost less and earn more because they last longer!

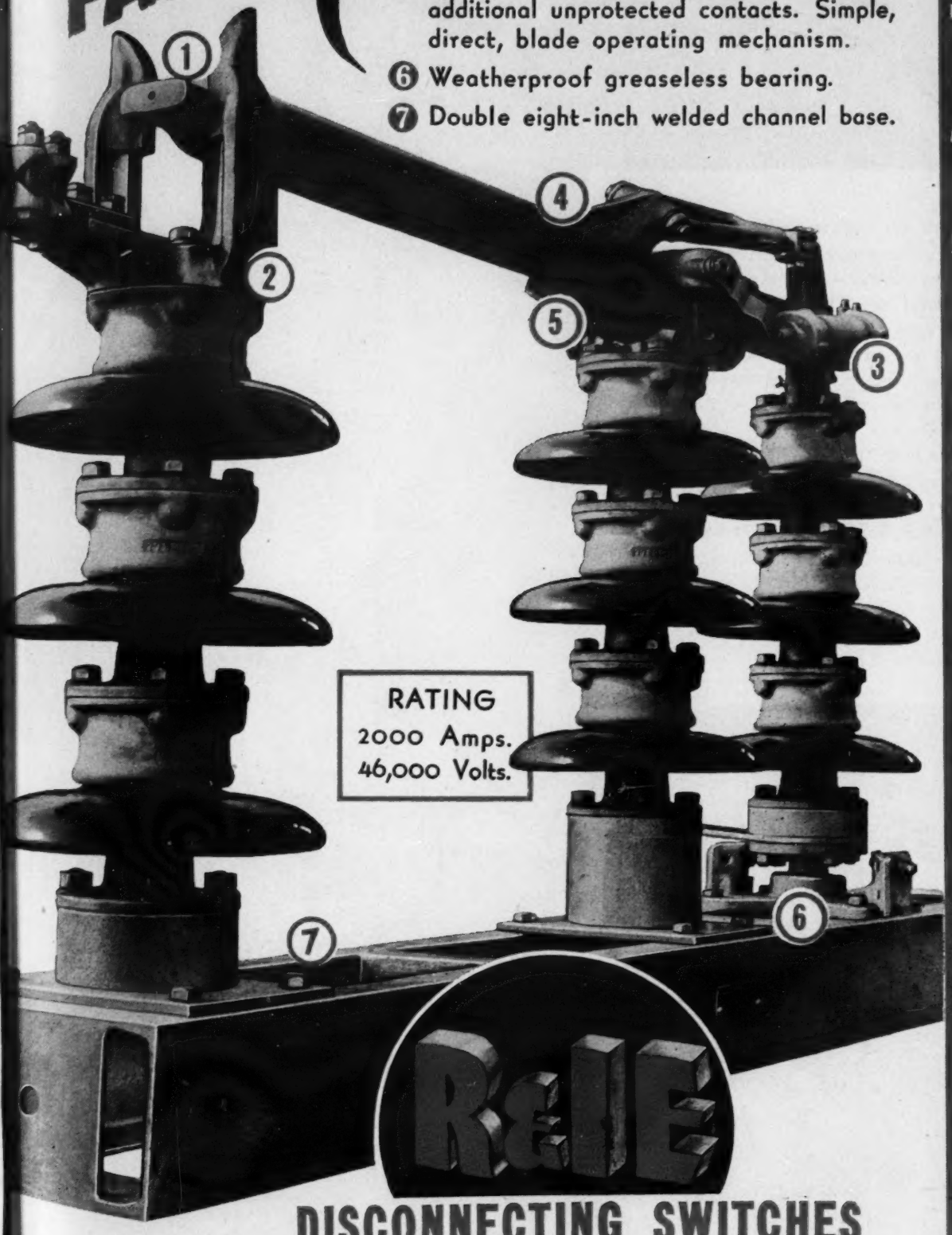
## Consolidated Treating Company

Minneapolis Minnesota

**LIFE-SPAN *Full-Length Treated* CEDAR POLES**

# CHECK the FACTS

1. Hi-Pressure Contacts, self cleaning with each blade operation.
2. One piece jaw and terminal pad.
3. Blade counterbalanced in any position. Requires only normal operating effort.
4. All copper current carrying parts.
5. Heavy braid flex at hinge joint—eliminates additional unprotected contacts. Simple, direct, blade operating mechanism.
6. Weatherproof greaseless bearing.
7. Double eight-inch welded channel base.




R&IE

## DISCONNECTING SWITCHES

*The Check List*

- CONDUCTOR SUPPORT CLAMPS AND FITTIN
- ✓ DISCONNECTING SWITCH INDOOR AND OUTDOOR
- AIR BREAK SWITCH
- INTERRUPTER SWITCH
- CUTOUTS AND THERMO-RUPTERS
- SWITCH OPERATIN MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSE
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC SECTIONALIZING EQUIPMENT
- METAL CUBICLES
- TESTING DEVICES

**RAILWAY AND INDUSTRIAL ENGINEERING CO.** GREENSBURG, PA.

IN CANADA—EASTERN POWER DEVICES, LIMITED, TORONTO

# So Simple, So F

YOU SAY GOODBY to by-guess and by-memory methods when you plan substations *visually* — with the help of Allis-Chalmers' new "Unit Sub Builder" Set!

At a glance you see what's available — the various ways it can go together — and build up the solution to your power distribution problem *right on the top of your desk.*

The new "Unit Sub Builder" will be shown by a field engineer from your nearby A-C district office on your request. A new Slide Rule and Check List save your time, contribute to better planning. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

• • •

♪ *Tune in the Boston Symphony, Blue Network, every Sat. Eve.*

A 1745

ALLI

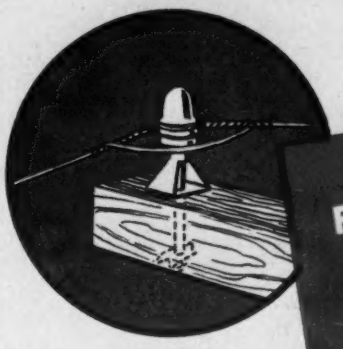
# Practical, So Fast-

## *Visual Planning for Unit Subs!*

Here's the new way to buy Unit Substations—with your eyes wide open—aided by accurate scale models of Allis-Chalmers electrical apparatus.

YOUR UNIT SUB IDEAS WORKED OUT WITH

ALLIS-CHALMERS *"Unit Sub Builder" Set*



FOR UNBALANCED STRESSES . . .

# OLIVER

## ALL-PURPOSE REINFORCED INSULATOR PIN

**(PATENTED)**

A relatively new item in the complete line of Oliver Pole Line Materials is the low voltage All-Purpose Reinforced Insulator Pin. The heavy steel (9 gauge) saddle welded to the pin provides the strength needed to withstand strains encountered in long spans, and in angle and corner installations. Specially suited for use with modern high-strength conductors. Desirable also for tangents to prevent bent pins on up and down grades.

With the new Oliver All-Purpose pin, more uniform strength of overall construction is obtained. Costs are kept low and your stocking problem is simplified as it is not necessary to use special pins for corner construction.

*Dimensions:* 5 in. from bottom of saddle to top of pin; 5½ in. from bottom of saddle to bottom of shank; width of saddle, 2¾ in.

Steel saddle firmly welded to pin absorbs excessive transverse and longitudinal loads.
1" lead thread for insulator.
¾" dia. shank, hot dip galvanized.
Saddle base curved to fit roofed cross-arms.
Threaded to accommodate various arm depths.
Lock washer assures firm hold on cross-arms.
The new Oliver Catalog contains 190 pages of data and information on modern line materials. Send for your copy today.
POLE LINE MATERIALS

OLIVER IRON AND STEEL Corporation

SOUTH TENTH AND MURIEL STREETS . . . PITTSBURGH 3, PENNA.

# OPERATE YOUR SYSTEM MORE EFFICIENTLY *with carrier telemetering*

Interconnection of generating stations and power systems has expanded the need for, and use of, telemetering. With lines loaded to the limit, accurate information on power flow and system characteristics is more vital than ever before.

Carrier telemetering brings together at a common point significant quantities for efficient system operation. These quantities may be used independently for manual system control, or totalized to initiate automatic load control equipment. Automatic system control is particularly advantageous in regulating the net interchange of power between large interconnected systems.

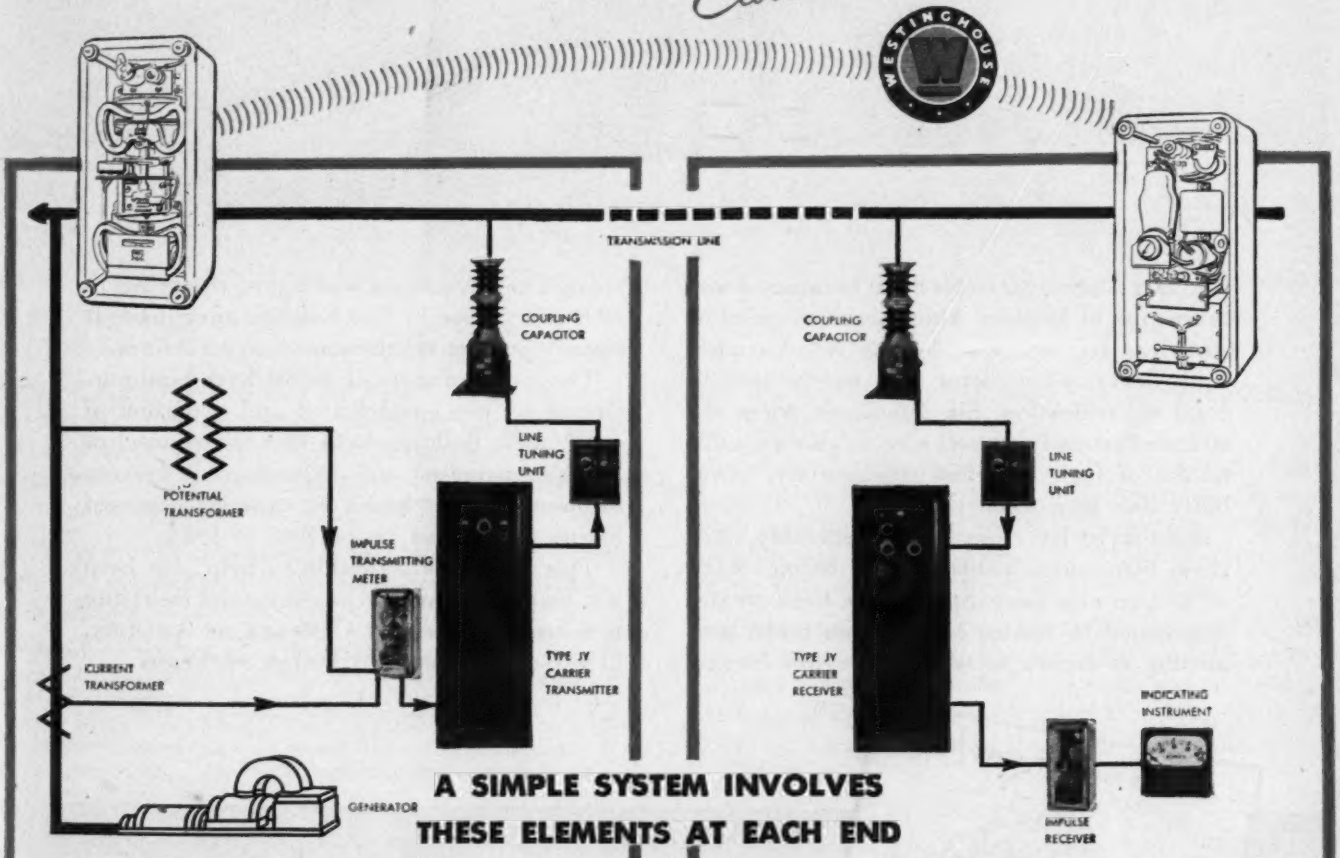
Westinghouse carrier telemetering equipment is basically simple, and can be adapted to a wide range of requirements. Your nearest Westinghouse office can offer valuable aid in planning an application to meet your needs. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa

J-97087

**Westinghouse**

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

*Electronics at Work*




## A SIMPLE SYSTEM INVOLVES THESE ELEMENTS AT EACH END

### AT SENDING END

**A MEASURING DEVICE**—which responds to the desired quantity, and initiates impulses to actuate the carrier transmitter.

**CARRIER TRANSMITTER**—to generate the carrier current.

**LINE TUNING UNIT**—cancels the impedance of the coupling capacitor.

**COUPLING CAPACITOR**—through which the carrier flows.

### AT RECEIVING END

**COUPLING CAPACITOR**—through which the carrier flows to the receiver.

**LINE TUNING UNIT**—cancels the impedance of the coupling capacitor.

**CARRIER RECEIVER**—that receives and rectifies the carrier impulses, converting them to d-c impulses.

**AN IMPULSE FILTER**—which converts impulses received at a given rate into a dial reading or chart recording.

# Styles *have* changed since 1909, the year the first ACSR was made

Electric range, vintage of 1909

Line styles have changed, but the ACSR on this modern line follows the original formula; steel for strength, aluminum for conductivity and long life.

The first Aluminum Cable Steel Reinforced was fabricated in 1909 by Aluminum Company of America. Its size was No. 2 (No. 4 copper equivalent); a conductor now widely used in rural electrification. Six aluminum wires are stranded around one steel wire, to give a combination of high electrical conductivity, durability and high strength.

Line styles have changed considerably since then. Structures, insulators and fittings have all put on new faces. Spans have been greatly lengthened to reduce construction costs, permitting extension of service into low income areas. The advantages which gave the ACSR of 1909 acceptance by line builders have made it equally popular for these modern rural lines.

Thousands of miles of ACSR have been purchased for the construction and extension of rural lines. Builders have had the counsel of Alcoa's engineers and supervisors, receiving recommendations based on experience gained during these many years, 1909 to 1944.

This service is available to help you keep war-loaded lines on the job, or extend them into new areas. ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh 19, Penna.

ALCOA A·C·S·R

ALUMINUM CABLE STEEL REINFORCED

# Announcement of importance to the Electrical Industry

## Geon
### Vinyl Resins & Plastics

**Versatile synthetic materials offered for**

## INSULATION AND SHEATHING OF ELECTRICAL WIRE AND CABLE

FROM GEON resins may be made a wide variety of thermoplastic elastomers, possessing unusual electrical and mechanical properties. These materials can be extruded, pressure or injection molded, calendered, or cast into sheet and film.

Here are the specifications and properties of a representative formulation of GEON for cable insulation, in this instance, GEON 2046:

| | |
|---|---|
| Dielectric strength | 800 volts per mil |
| Insulation resistance | 6.0 x $10^{15}$ ohm-cm @ 15.5° C. |
| Dielectric constant | 6.0 @ 15.5° C. |
| Power factor | .09 @ 15.5° C. |
| Chemical resistance | Outstanding |
| Flame resistance | Will not support combustion |
| Abrasion resistance | Excellent |
| Air and ozone resistance | Excellent |
| Moisture absorption | Comparable to best grades of rubber |
| Tensile strength | 2500 p.s.i. |
| Elongation | 300% |
| Oil resistance | Excellent |
| Aging and light resistance | Excellent |
| Color range | 14 Standard NEMA colors |

GEON insulation and sheathing can be extruded directly onto the wire or formed into slip-on tubing. GEON film or GEON-treated materials can be made into tape for very fine insulation. GEON can be molded into plugs, connectors, etc.

By varying the type of GEON resins and plasticizers a great number of different combinations of properties may be obtained. Or, GEON, properly blended with certain synthetic rubbers, will impart to the rubber characteristics otherwise unobtainable.

The complete GEON story cannot be told in this limited space. But our research staff and laboratory facilities are available to help you work out any special problems or applications. Chemical Division, The B. F. Goodrich Company, Rose Building, Cleveland, Ohio.

★ ★ ★

For an informative folder which further describes GEON'S properties and suggests many applications, or for answers to your questions, write Dept. C-1, Chemical Division, Rose Building, Cleveland 15, Ohio.

GEON is available to industrial users subject to allocation under General Preference Order M-10. Limited quantities can be had for experiment.

# *CHROMEL won't let you down*

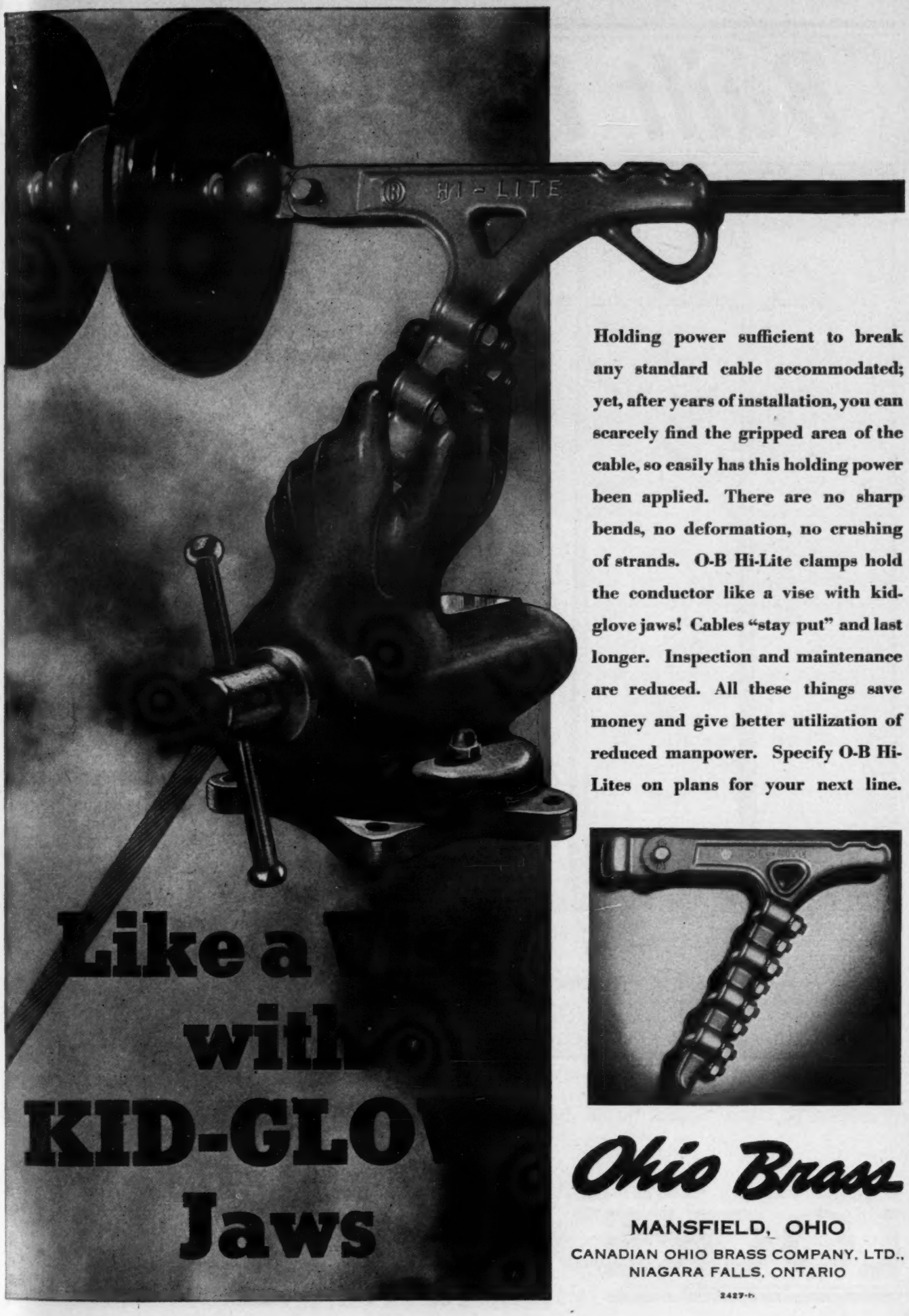
It would be fine for everybody (but us!) if Chromel heating elements never wore out —but, of course, they do. Likewise, it is fine for everybody that Chromel does last so long. This heating-element wire has proven so faithful a performer, over so many years, that you just know that Chromel won't let you, or your customers down. Thus, Chromel has the ready acceptance, as heating element material, by engineers who specify it, and by the device maker who gladly entrusts his good name to the good performance of Chromel. For technical data, ask for Catalog-M.

**RESISTIVITY @ 68°F**

| | WIRE (C.M. Ft.) | RIBBON (Sq. M. Ft.) |
|---|---|---|
| Chromel-A | 650 Ohms | 510 Ohms |
| Chromel-C | 675 Ohms | 530 Ohms |
| Chromel-D | 600 Ohms | 471 Ohms |
| Copel | 294 Ohms | 231 Ohms |

Chromel
NICKEL CHROMIUM
HOSKINS CHROMEL
ELECTRICAL HEATING ELEMENT
WIRE

**HOSKINS MANUFACTURING COMPANY, DETROIT 8, MICHIGAN**




**Holding power sufficient to break any standard cable accommodated; yet, after years of installation, you can scarcely find the gripped area of the cable, so easily has this holding power been applied. There are no sharp bends, no deformation, no crushing of strands. O-B Hi-Lite clamps hold the conductor like a vise with kid-glove jaws! Cables "stay put" and last longer. Inspection and maintenance are reduced. All these things save money and give better utilization of reduced manpower. Specify O-B Hi-Lites on plans for your next line.**



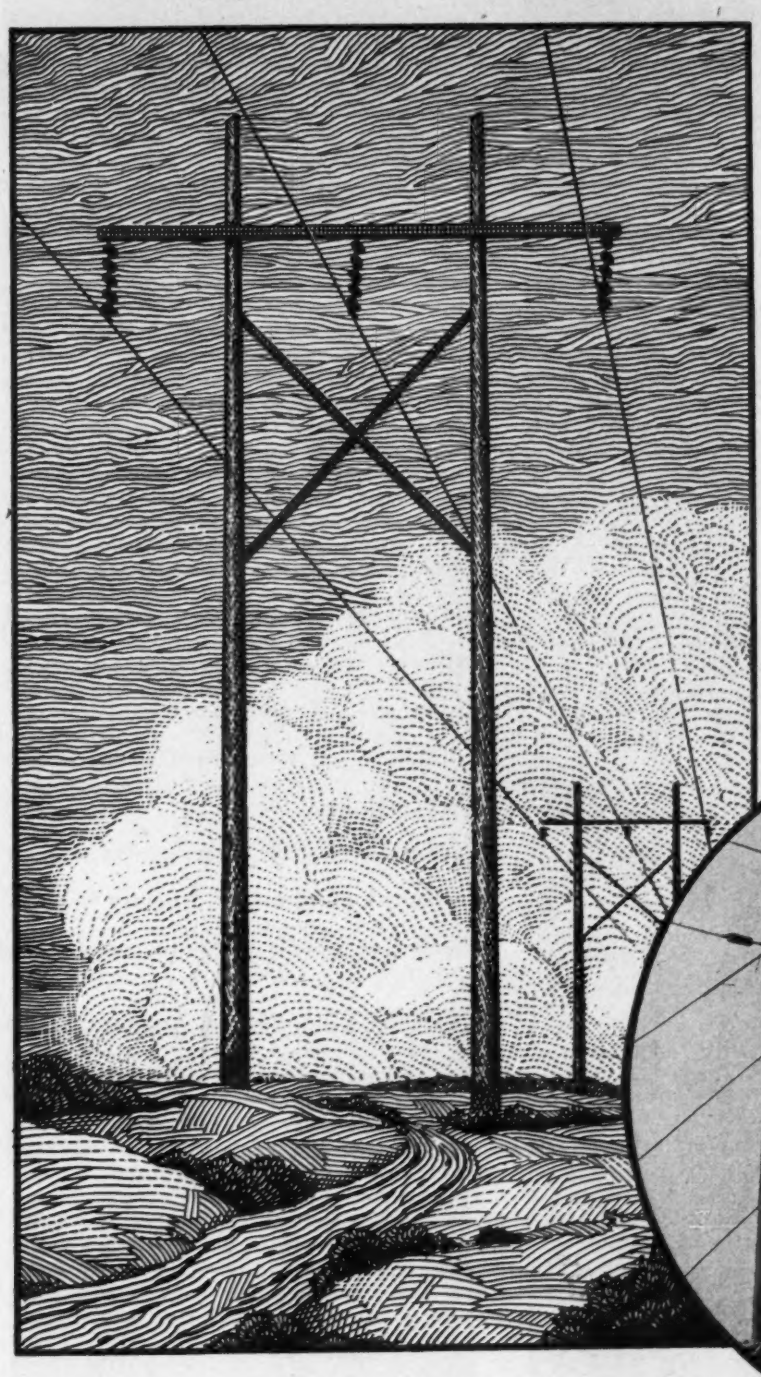
**Ohio Brass**

MANSFIELD, OHIO

CANADIAN OHIO BRASS COMPANY, LTD.,
NIAGARA FALLS, ONTARIO

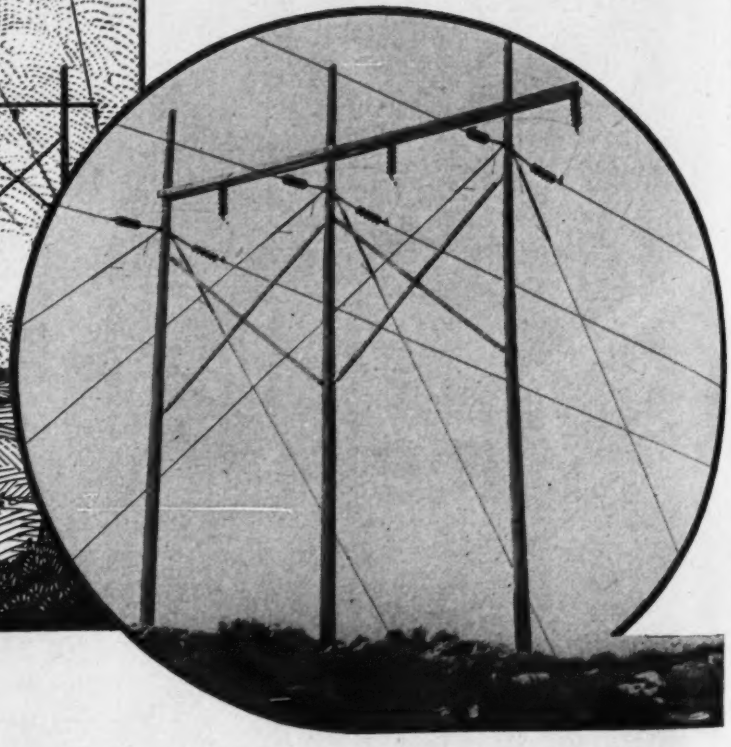
2427-b

# Built For Today . . .



A sketch of the straight line construction. Ground wires will later be installed flexibly connected to the pole tops.

Below a typical dead end structure. On the next page corner construction used at all angles.



ORIGINATOR AND LARGEST MANUFACTURER OF WET-PROCESS PORCELAIN INSULATORS

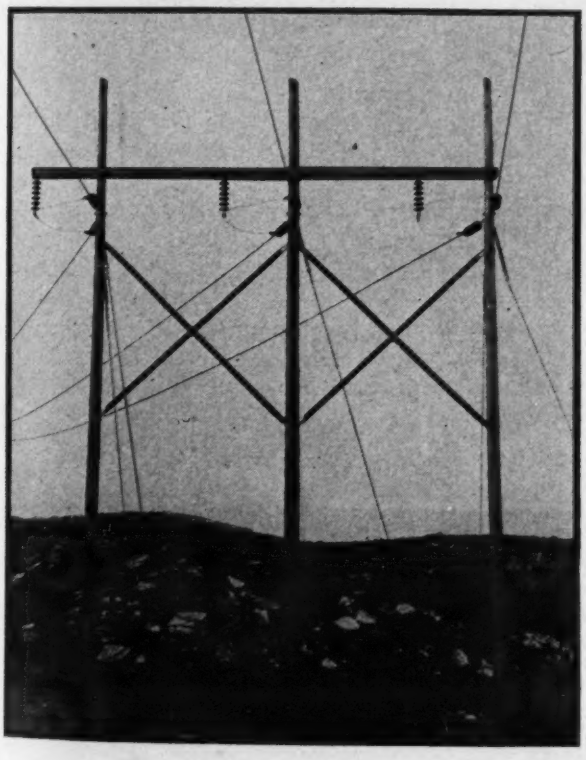
# LOCKE INSULATOR

FIRST IN CLAYRAMICS

# . . . but Planned for Tomorrow

Locke suspension insulators and Locke high-line hardware are used throughout on this model line.

**SOUTHWESTERN PUBLIC SERVICE COMPANY ENGINEERS LOOK TO POST-WAR DEMAND**



**The problem was to deliver power—lots of it—continuously—to several widely separated war plants—in a hurry.**

**Southwestern Public Service Company engineers met this demand by designing the simplest possible transmission line consistent with reliability, using nothing but standard materials and a minimum of hard-to-get or otherwise needed materials.**

***Not content with this alone, they considered postwar demand.***

**First, 66 KV operation did meet all present needs and used less restricted material than higher voltages. But constructing for ultimate use at a higher voltage could be done with readily available materials and with no sacrifice of time.**

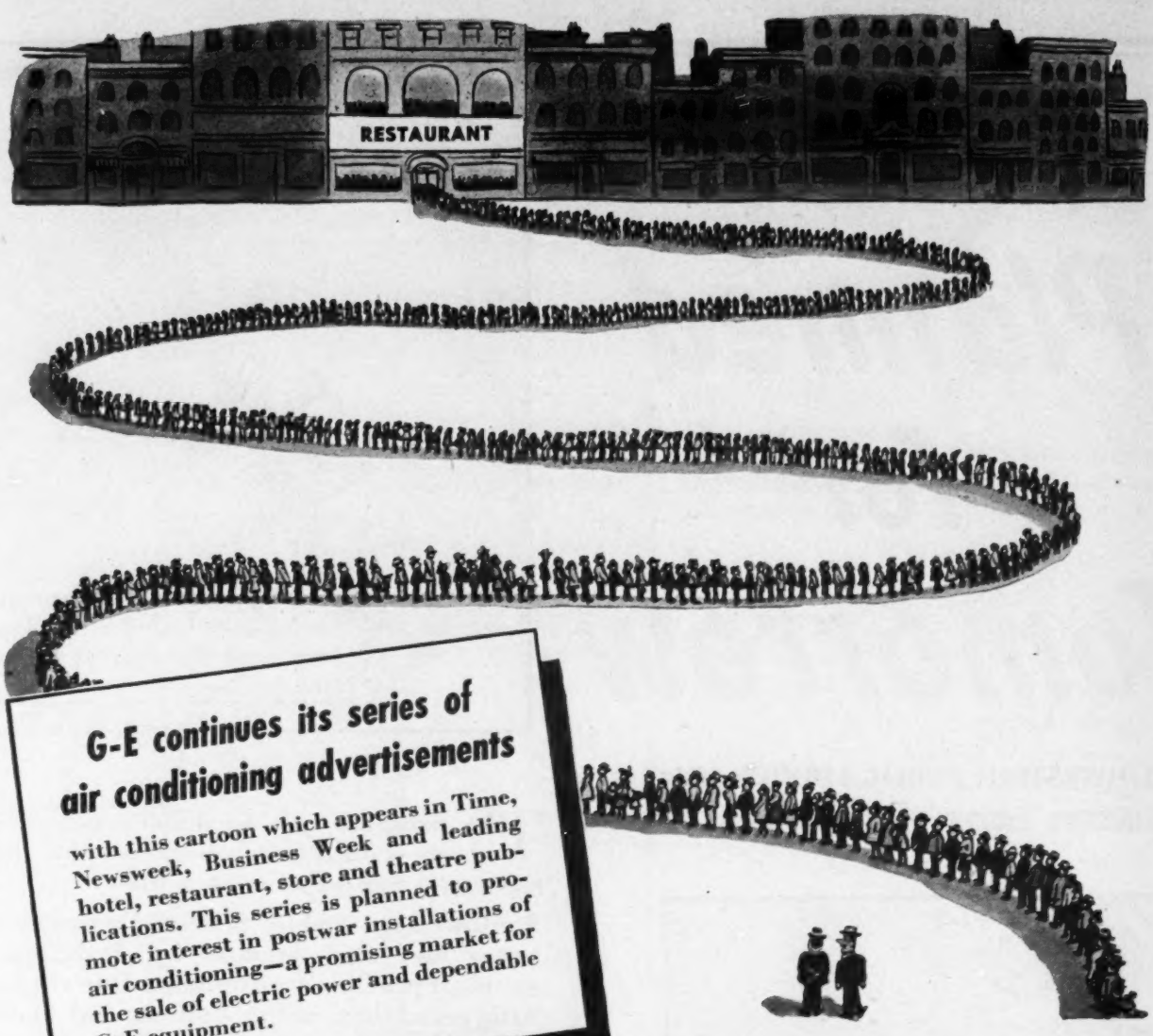
**The result is the 66 KV line illustrated here. Ultimately the voltage will be stepped up to 115 KV by the simple expedient of increasing the insulation and adding ground wires.**

***The war-time baby will become a peace-time adult stretching a time and labor saving hand over hundreds of square miles of territory.***

FIFTY PROGRESSIVE YEARS OF SERVICE TO THE ELECTRICAL INDUSTRY

**CORPORATION** BALTIMORE MARYLAND

FIRST IN CLAYRAMICS




## G-E continues its series of air conditioning advertisements

with this cartoon which appears in Time, Newsweek, Business Week and leading hotel, restaurant, store and theatre publications. This series is planned to promote interest in postwar installations of air conditioning—a promising market for the sale of electric power and dependable G-E equipment.

*"Now that they've put in Air Conditioning you have to stand in line to get in."*

IT'S a nice thing for the restaurant owner. Every hot summer day acts as a reminder to his patrons to come in and enjoy his good food . . . and his good air conditioning.

Furthermore, the fresh, cool, air-conditioned atmosphere does wonders for appetites. The customers eat more . . . come in more often. His waiters give better service.

Good air conditioning (G-E Air Conditioning) is good business. Good for restaurants, good for your business too.

Of course, if you don't have G-E Air Conditioning now, you *will* have to wait awhile to get it. Right now, vital war duty is waiting for all the equipment we can produce. But even this cloud has a silver lining . . .

Out of G-E's wartime experience will come even finer equipment . . . compact, efficient, with balanced and uniform control of temperature and humidity.

Come Victory, G-E air conditioning will be in great demand—so it's none too soon to start planning *your* postwar installations. *General Electric Company, Air Conditioning and Commercial Refrigeration Divisions, Section 4196, Bloomfield, New Jersey.*

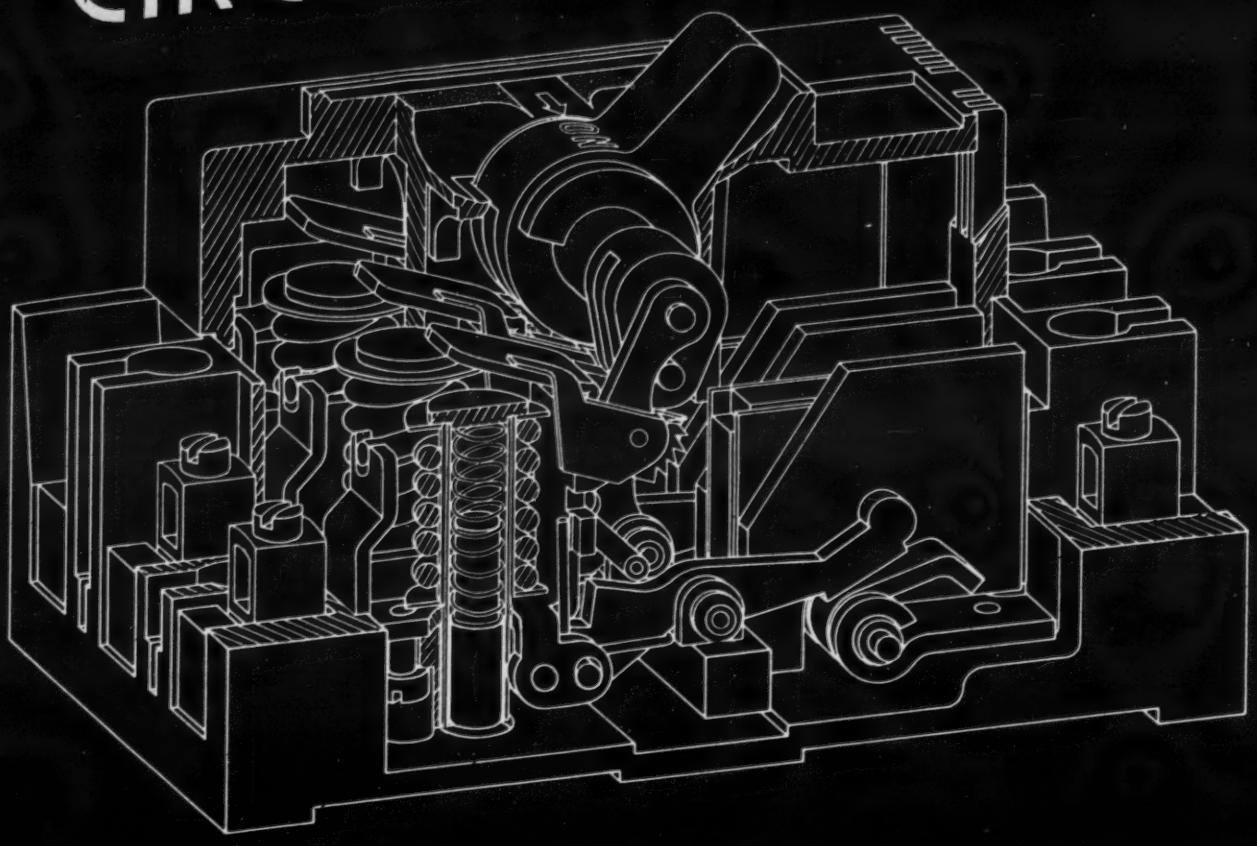
☆ BUY WAR BONDS ☆

*Air Conditioning by*

**GENERAL ELECTRIC**

Hear the General Electric Radio Programs: The "G-E ALL-GIRL ORCHESTRA," Sundays 10 P. M., EWT, NBC . . . "THE WORLD TODAY" News, Every Weekday, 6:45 P. M., EWT, CBS

# FLEXIBLE but UNFAILING CIRCUIT PROTECTION



# HEINEMANN

## *MAGNETIC CIRCUIT BREAKERS*

Drawing shows cross section of time delay type breaker, designed to prevent nuisance trips on transient overloads and starting surges, while opening rapidly on sustaining and heavy overloads and instantaneously on short circuits. Same breaker can be made without the time delay arrangement as straight instantaneous trip type. Magnetic blowout provides high and fast interrupting capacity.

HEINEMANN CIRCUIT BREAKER CO.

*Subsidiary of Heinemann Electric Co., Est. 1888*

TRENTON • NEW JERSEY

❶ Core is made of high grade electrical sheet steel laminations insulated to insure minimum core loss.

❷ Coils are form wound, and thoroughly insulated before being placed in the slots. Coils are securely held in slots by fibre wedges and the ends securely braced to prevent movement.

❸ Frame constructed of welded steel with heavy cross ribs to rigidly support core laminations. Stator is well ventilated, the solid coil shields directing flow of air over coils and exhausted in frame openings.

❹ Field Coils form wound, thoroughly dipped and baked. Coils are well insulated from poles, and fitted fibre washers hold them permanently tight.

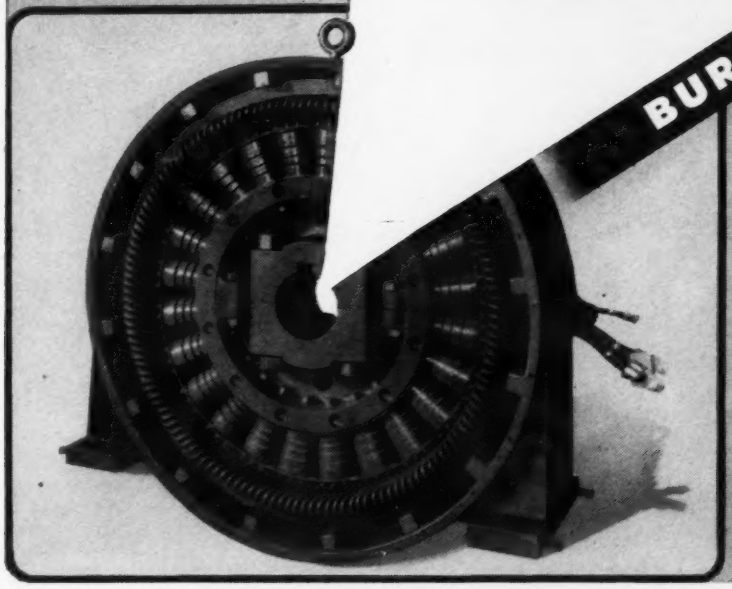
❺ Each Pole Assembly is securely fastened to the Rotor by 2 large studs thru rim and anchored in large rectangular steel rivet insert which serves to hold laminations firmly together.

❻ Rotors are of heavy all steel construction. Rotor made with solid hub, split hub, or can be completely split.

❼ Starting winding embedded in pole face and brazed to end rings which are riveted between poles.

❽ Collector Rings are of bronze with good wearing and conductive properties.

BURKE BUILT IS WELL BUILT



# BURKE

## SYNCHRONOUS MOTORS AND GENERATORS

TYPICAL of the construction of the larger Burke Synchronous Motors and Generators is that detailed here. Burke as one of the oldest builders of Synchronous equipment, has stressed quality in every detail for over fifty-four years. These motors are built to meet your specifications and are available in all sizes from 1 to 1500 h. p. in belted, direct or engine types either sleeve or ball bearing equipped and with Exciter on top or direct connected. Burke engineers are ready to meet your war demands or to help you prepare for the post war period.

*Write today for specific data.*

**BURKE ELECTRIC COMPANY • ERIE, PA.**

SYNCHRONOUS MOTORS AND GENERATORS | INDUCTION MOTORS | D. C. MOTORS | D. C. GENERATORS | M. G. SETS | HIGH SPEED A. C. GENERATORS

MOTORS 1 TO 1500 H. P. • GENERATORS 1 TO 1000 K. W.

**BURKE** A.C. & D.C. Motors & Generators

BURKE ELECTRIC COMPANY, ERIE, PENNSYLVANIA • *Since 1891*

Chicago Subway showing *Flur-o-guide* fluorescent units typical of those used throughout the system to provide safe, eye-easy illumination. Corning Flur-o-guide Alba Panels No. 90960 are used throughout.

Corning Glass Works does not manufacture or sell lighting fixtures. Complete units shown are obtainable from fixture manufacturers.

# CORNING *Flur-o-guides*

## PROVIDE ENGINEERED LIGHTING FOR CHICAGO SUBWAY

Illumination is one of the outstanding features of the new Chicago Subway. Fluorescent lighting is used with specially designed Corning *Flur-o-guide* light-diffusing panels. Working in conjunction with Corning, the subway engineers have provided illumination that is uniform, glareless, and easy on the eyes. The first such installation in the country, the system includes some 3000 totally enclosed fluorescent units equipped with 48-inch lamps. Approximately 1200 units with incandescent lamps are used for emergency lighting.

## ENGINEERED LIGHTING PUTS LIGHT TO WORK

Corning *Flur-o-guides* permit the adaptation of light to the job it has to do. With the properly designed *Flur-o-guides*, developed to the best engineering principles by Corning Engineers, complete utilization of light is possible. For general illumination *Flur-o-guides* are available which give wide angle distribution of the light. Where a particularly high concentration of light is required in a given area, Corning provides a complete line of fresnel-type lens panels that concentrate the light where it is needed. They will be available in a wide range of styles and sizes for every fluorescent lighting application, when war demands slacken.

Write for "Corning Lighting Data," giving complete information on how you can apply engineered lighting to your illumination problems. Address Lighting Division, Dept. EW2 Corning Glass Works, Corning, N. Y.

*"CORNING" is a registered trade-mark and indicates manufacture by Corning Glass Works, Corning, New York*

CORNING *means* research in Glass

**Corning Engineered Lightingware**

BRAND

# Have You Seen It?

THIS new postwar, general purpose Fairbanks-Morse Motor is available to industry now.

Never before have there been more stamina—more protection—more versatility—built into a motor housing.

You'll have to see it demonstrated to appreciate fully how much this motor can really offer you.

**BUY WAR BONDS**

### *Look at These Features!*

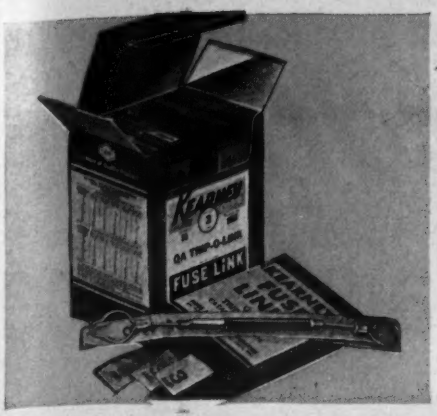
- ★ It is a 40°C. motor.
- ★ It is a protected motor.
- ★ It has an optional conduit box assembly.
- ★ It has cross-flow ventilation.
- ★ It has ball bearings—sealed-in and protected.
- ★ It has the exclusive Fairbanks-Morse COPPERSPUN ROTOR.

Write for detailed information. Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.

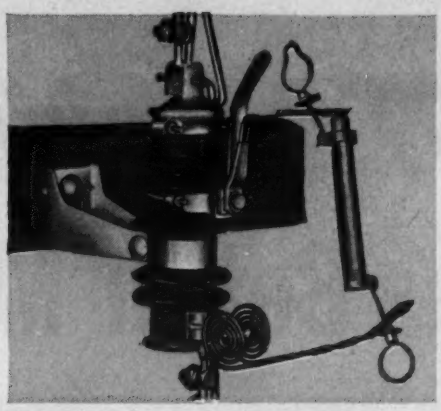
## FAIRBANKS-MORSE

DIESEL ENGINES
PUMPS
MOTORS
GENERATORS
WATER SYSTEMS
SCALES
STOKERS
FARM EQUIPMENT
RAILROAD EQUIPMENT

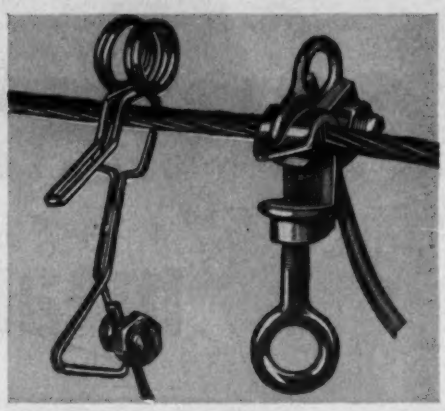
Motors




**FUSE LINKS**—individually wrapped, then packaged again in packets of five, arrive at the pole just the way they leave the Kearney factory.



**LIGHTNING STROKES** dissipated through low resistance path to ground. Power follow-up interrupted within the horn fibre fuse tubes.



**CLAMPS.** There is a Kearney Con-nec-tap clamp for the most unusual load or construction problem. Made in many types for all wire sizes.

# RELATED CONSTRUCTION UNITS

One certain way of eliminating maintenance on any mechanical or electrical device is to replace worn or used parts after each operation. Sounds impractical but have you looked at the Kearney Trip-O-Link Fuse Switch? The porcelain in the insulator being an inert material is impervious to wear and tear. The hanger and fittings attachments made of carefully chosen materials, are in much the same category. Damage and wear caused by lightning, short-circuits and excessive loads are nearly always confined to the cartridge of a fuse switch. With the Trip-O-Link the ideal is closely approached because each re-fusing brings with it a fresh, full-dimensioned fibre-lined cartridge as an integral part of the fuse link. At the same time clean contacts are made because the bright new cable of the fuse links goes directly into the permanent switch contacts. In these days of revolutionary designs, take time out to investigate the Trip-O-Link. Please address your letter to Department "H,"

**JAMES R. KEARNEY CORPORATION,**
**4236 Clayton Ave., St. Louis 10, Missouri**

POSITIVE — LIGHT-WEIGHT — SAFE — LOW-COST

**THIS ELECTRICAL INSTALLATION** is typical of the way in which you too, can take advantage of many Kearney Products made expressly for better performance at the least possible cost.

**KEARNEY**
**ELECTRICAL**
**PRODUCTS**

# CORRECT Lubrication means Better Maintenance

**CORRECT** lubrication makes for better maintenance by preventing excessive wear.

Because no one oil meets all requirements Sinclair provides both Rubilene and Gascon Oils for *correct* lubrication of *DIESEL ENGINES.* These oils are *safe* lubricants under today's continuous heavy duty operation. Their range is suited to all service conditions.

Where prolonged heavy duty operation threatens excessive wear there is a lubrication problem. Consult us about it.

*(Write for "The Service Factor" — published periodically and devoted to the solution of lubricating problems.)*

## SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.

# HOW BIG A CABLE?

**The impedance characteristics of Ultra-High Frequency Cables are dependent on the physical dimensions – the size of center conductor and the inside diameter of the coaxial braid.**

**You can easily determine impedance by the use of this Intelin Chart. Apply a straight edge, with the crossover at the desired impedance on the center scale. The other two scales then indicate, for any scale position, the corresponding conductor size and dielectric size necessary for the desired impedance.**

**A full size copy of this chart is yours on request. Write for it today!**

**Remember, Intelin Cable is more than insulated wire – it is specialized transmission line – made with watchmaker accuracy.**

**In the Intelin Cable family there is a type to match your ultra-high-frequency problems, a cable balanced in all electrical properties to do your job.**

**BUY MORE BONDS**

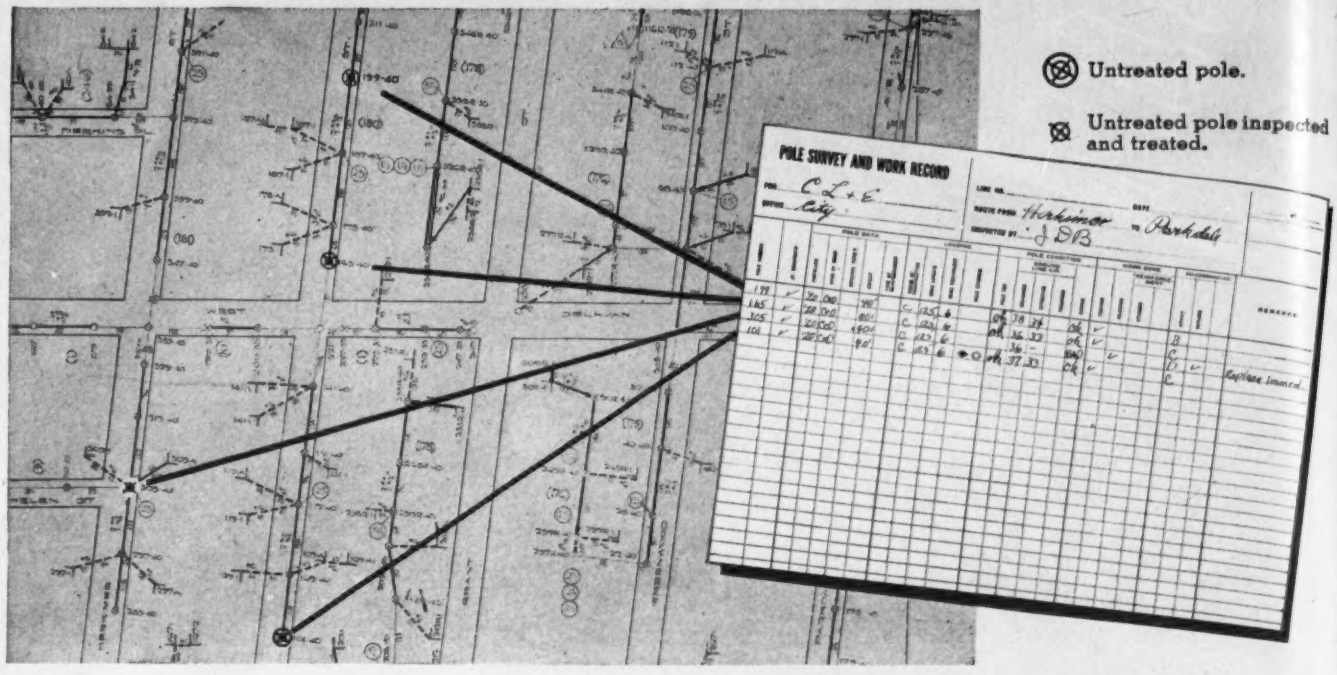
**INVEST IN THE FUTURE**

*Federal, long recognised as a manufacturer of better vacuum tubes, now leads with new production methods resulting in still greater tube efficiency and length of life. Everywhere, it's Federal tubes for superior transmitting and industrial power performance.*

*Federal Telephone and Radio Corporation*

AN IT&T ASSOCIATE

Newark 1, N. J.



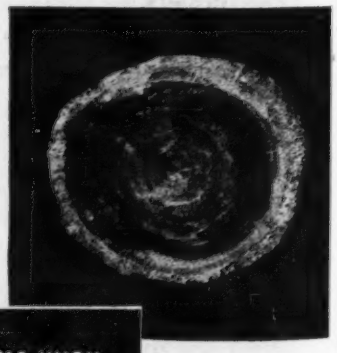

# *How One Leading Utility makes*

# INSPECTION TIME PROTECTION TIME *with* OSMOPLASTIC

Reproduced above are the basic records employed by a large electric utility to accurately control the maintenance of standing poles in their overhead distribution system.

Under this system, every pole is numbered and mapped. A glance at the map shows the condition of all poles in the area covered . . . symbols indicating whether they are treated or untreated. Filed with the map, is a pole inspection record giving detailed information on the poles which need treating, plus the data on those which have been inspected and treated. Thus does one utility intelligently MAKE INSPECTION TIME PROTECTION TIME with OSMOPLASTIC.

Today, more than 100 prominent utilities are treating poles with OSMOPLASTIC. To date, over a million and a half poles have been so treated to greatly increase their useful life. If you are interested in a record control system similar to that described above, we would be glad to discuss the matter with you in detail.



The white outer area of this pole cross-section, cut at groundline, shows the deep penetrating action of the toxic chemicals in Osmoplastic.

MAKE INSPECTION TIME, PROTECTION TIME WITH

**OSMOPLASTIC**

MANUFACTURED BY

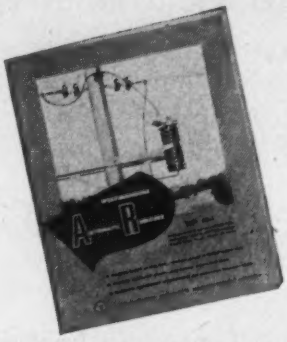
OSMOSE WOOD PRESERVING COMPANY OF AMERICA, INC.

GENERAL OFFICES: BUFFALO 12, N. Y.

BRANCH AND SALES OFFICES: BIRMINGHAM 3, ALA.; DENVER 2, COLO.; NEW YORK 7, N. Y.; KENOVA, W. VA.; HARLAN, KY.; CHICAGO 4, ILL.

## GET THIS BULLETIN

This bulletin—B-3329—presents complete application data on the new AR-1 Reclosers. It describes how to co-ordinate them with other protective devices, gives features, dimensions, methods of mounting and ordering information. Ask your nearest Westinghouse distributor for a copy today. Or, write Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N.



Your Westinghouse distributor offers two ready answers to circuit protection problems on extended distribution lines.

*First:* Westinghouse Type AR-1 Reclosers which give maximum protection with minimum outages on long rural systems.

*Second:* The distributor's own "how-to-do-it" ability . . . based on his own and Westinghouse experience in similar applications.

On temporary faults, the AR-1 Recloser *opens, recloses* and *resets itself.* It is then ready for operation over the same cycle. If the line fails to clear, the recloser attempts to re-energize the line three times and then locks out. Ample time delay on tripping permits co-ordination with other reclosers and standard fuses to reduce line outages to an absolute minimum.

The AR-1 Reclosers eliminate inspection and service trips on transient faults, avoid revenue loss on unnecessarily dead lines, improve suburban rural line service, build customer good will. Ask your Westinghouse distributor about them today. J-90510

# TRIED THESE ANSWERS TO UNNECESSARY OUTAGES?

TAP THE "HOW-TO-DO-IT" ABILITY OF YOUR WESTINGHOUSE DISTRIBUTOR

SEE YOUR WESTINGHOUSE DISTRIBUTOR *FIRST!*

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

# For Your Future Expansion

BY HELPING TO AVOID WASTE, save fuel, cut costs and by providing an extra margin of safety, Johns-Manville Electrical Materials are making their contribution to the Electrical Industry's great wartime record.

**Today, as a result of their proven dependability** under sustained peak loads and other critical operating conditions, these materials are playing an increasingly important part in the industry's plans for post-war expansion and rehabilitation.

**J-M Electrical Materials,** developed in the extensive Johns-Manville Research Laboratory, are backed by the knowledge accumulated through 86 years of operating experience.

* * *

The complete line of J-M Electrical Materials is described in Catalog GI-6A. Send for your copy today. Write Johns-Manville, 22 East 40th Street. New York 16, New York.

**OTHER JOHNS-MANVILLE PRODUCTS FOR THE ELECTRICAL INDUSTRY**

ELECTRICAL MATERIALS NOT ILLUSTRATED:

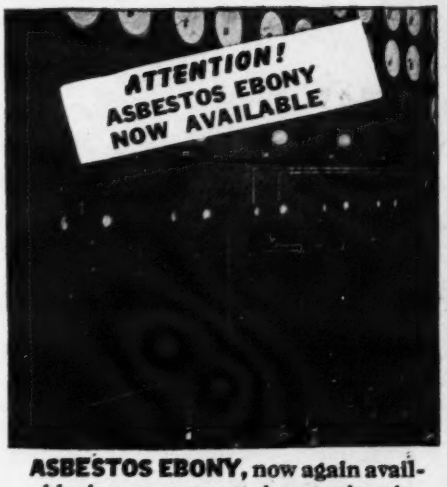
Chemstone
Electrobestos
Asbestos Tapes
Friction Tapes
Splicing Compounds
Asbestos Transite

ALSO

High Temperature Insulation
Refractories
Transite Partitions
Acoustical Materials
Packings
Built-Up Roofing
Industrial Flooring
Transite Pressure Pipe

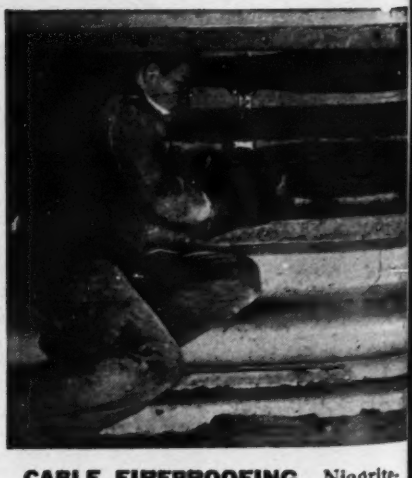
JOHNS-MANVILLE JM PRODUCTS

# Johns-Manville ELECTRICAL MATERIALS



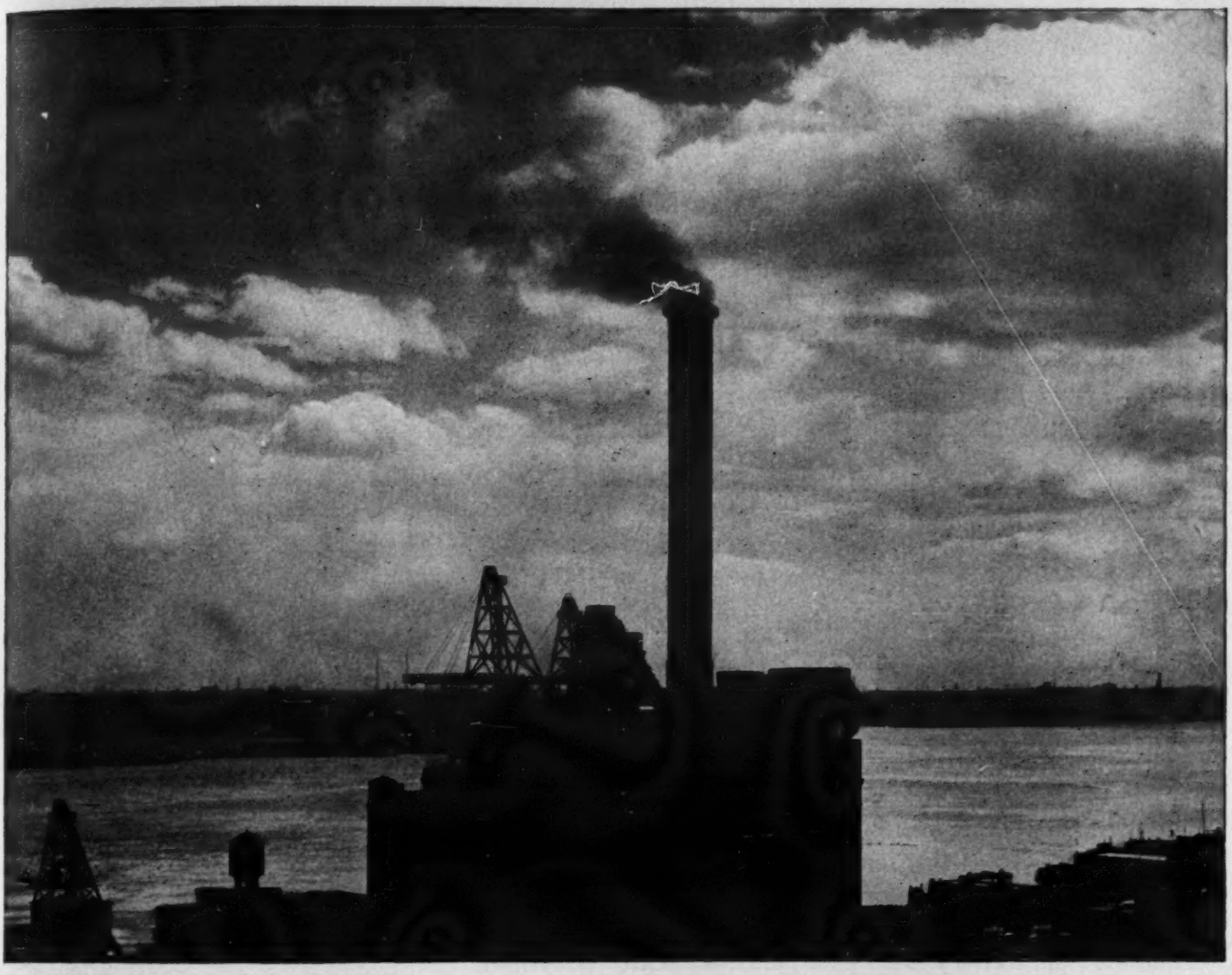

**ASBESTOS EBONY,** now again available, is a permanent, inorganic mineral product. It won't rust, rot, shrink, crack or buckle. Impervious to water, gas, oil, and ordinary chemicals. Has high dielectric strength and insulation resistance.

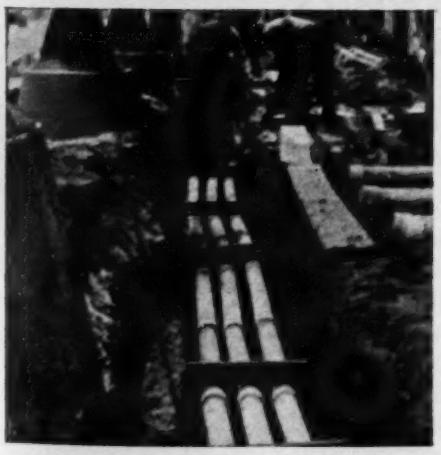
**TRANSITE CABLE TRAYS** are made of an incombustible, strong, corrosion-resistant material. Designed to support control cables. Transite Cable Trays save space, provide greater accessibility, cost less to install and need no maintenance.



**CABLE FIREPROOFING.** Niagrite-Asbestoment, consisting of Niagrite, a commercially pure asbestos felted tape with or without reinforcement, and an efficient refractory material, Asbestoment, provides fireproof protection for cables.

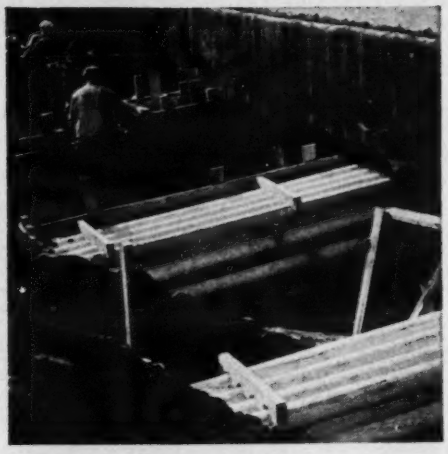
# ...consider these safer electrical materials





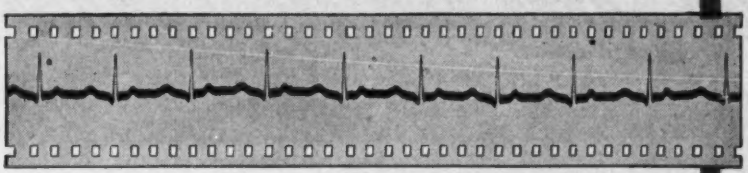
**TRANSITE CONDUIT.** Made of asbestos fiber and cement, Transite Conduit is approved for use underground without concrete envelope. Both Transite Conduit and Korduct help provide lower installation cost and reduced maintenance expense.

**SEALING COMPOUNDS.** J-M makes several sealing compounds—Duxseal, Pakseal, Tranolseal and Uniseal, each one with certain characteristics. All are easily workable at 35° F., with no slump at 300° F. They won't harden materially when exposed to air.



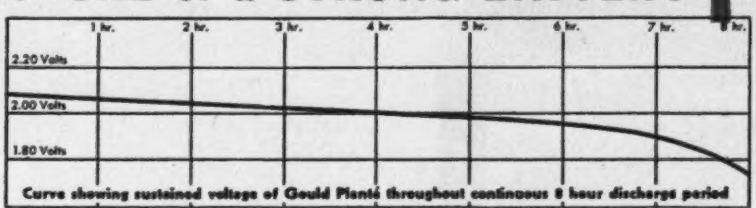
**TRANSITE KORDUCT** is identical with the Conduit except for its lesser wall thickness. Like Transite Conduit, Korduct is fireproof and highly resistant both to internal and external corrosion, electrolysis and action of soil chemicals.

## PICTURE of a STRONG HEART



Medical science has developed the electro-cardiograph for recording heart action on film. Through these recordings the physician can make accurate diagnosis.

## PICTURE of a STRONG BATTERY




Curve showing sustained voltage of Gould Planté throughout continuous 8 hour discharge period

The Gould Plante battery has an unusually high discharge rate. Like a strong heart it has the power to meet emergencies.

## NOT A MATTER FOR GUESSWORK

Your battery requirements are not a matter for guesswork. That is why Gould first sends its field engineers to get "on the spot" information. Experts in the nearest of the 11 Gould factories serving the United States convert that information into the right battery to do your job. Then Gould technicians make periodic tests to insure peak efficiency.

Have you received the latest edition of Bulletin 1000 describing Gould Sealed-In-Glass Batteries, racks, rectifiers and emergency lighting units? It is free. Write for it.

**GOULD STORAGE BATTERY CORPORATION, DEPEW, NEW YORK**

Factories: Atlanta • Chicago • Dallas • Depew • Leavenworth • Los Angeles • North Bergen
Rock Island • St. Paul • Sioux City • Zanesville

*FOR EXCELLENCE IN STORAGE BATTERY PRODUCTION AT DEPEW PLANT*

# GOULD

*Since 1898* THE BATTERY PICKED BY ENGINEERS


## SPINNING PLANTÉ PLATES

***One of a series of articles on Gould production methods.***

The Gould Plante battery has been most carefully designed. It is manufactured under the most rigid control, using for its essential raw material the highest quality of pure lead, obtainable from only two sources in the United States.

This pure lead is melted and blended to the desired Gould formula. It is then poured into molds three feet square and two inches in thickness and allowed to cool, forming a slab or billet which is now ready for its first operation of rolling.

It is successively passed back and forth in a rolling mill until the desired micrometric thickness is obtained. The resulting lead structure, as distinguished from plates of the cast type, is a close homogenous mass, free of crystalline structure.

The original slab or billet after rolling is now approximately thirty feet in length with a thickness of .279 inches. This strip of lead is next sheared into several individual pieces which are placed in a punch and trimmed to the desired outline of one or more plates dependent on the size desired.

The blank is then locked in a plate holder and reciprocated between high speed revolving arbors on which are spaced steel discs having knife-like edges to govern the required number of ribs per unit length. The arbors bearing against the blank surface under uniform air pressure cause the lead to displace and build up uniformly between the discs, producing the desired ribbed surface and spacing between ribs over the entire surface of the blank, this operation simultaneously taking place on both sides. This greatly increases the active surface area of the plate, an important factor in the unusually high capacity of the Gould Plante.

By limiting the depth to which the discs penetrate the blank, a core or central conducting rib remains in the center of the plate. This furnishes the required strength and current conducting member for the finished plate. With this flowing process, tendency toward gouging or tearing is eliminated with its accompanying destruction to metal structure.

This spinning is but one of the many operations in the production of the Gould Plante battery. It shows, however, the care and attention to details employed by Gould in each stage of manufacture. *(Advertisement)*

★ NUMBER 9 IN A SERIES, TRACING FIFTEEN YEARS OF KELLETT AIRCRAFT HISTORY ★

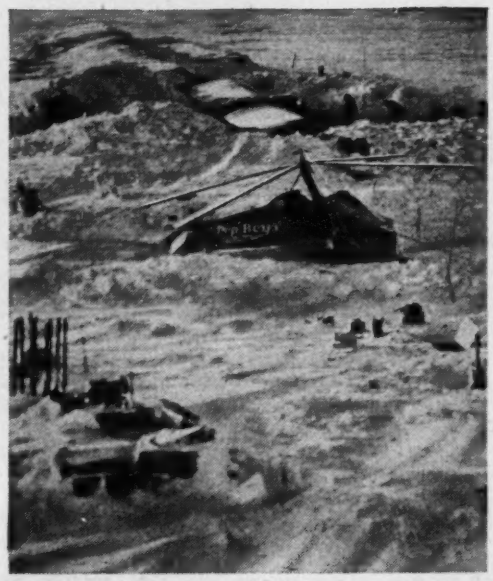
A 1943, autogiro-type, U. S. Army Air Forces Kellett coming in for a landing.

# New Horizons for Peace

TODAY, many organizations are participating in study and development in the helicopter field. We welcome this as a healthy sign of a potentially large industry beginning to grow . . . an indication that future accomplishments will be great under the American competitive system.

Now the Kellett organization is devoting all its aircraft-building experience to military production, to back up our men at the front. With Victory, Kellett's expanding engineering staff will focus on helicopter developments for civilian use. Our aim is to contribute, then, to the creating of *new* jobs, by making the time-and-money-saving advantages of helicopters available to electric utilities and pipe line companies for cross-country inspection and service, to ranchers, to farm cooperative groups for dusting and spraying, to prospectors and hosts of others.

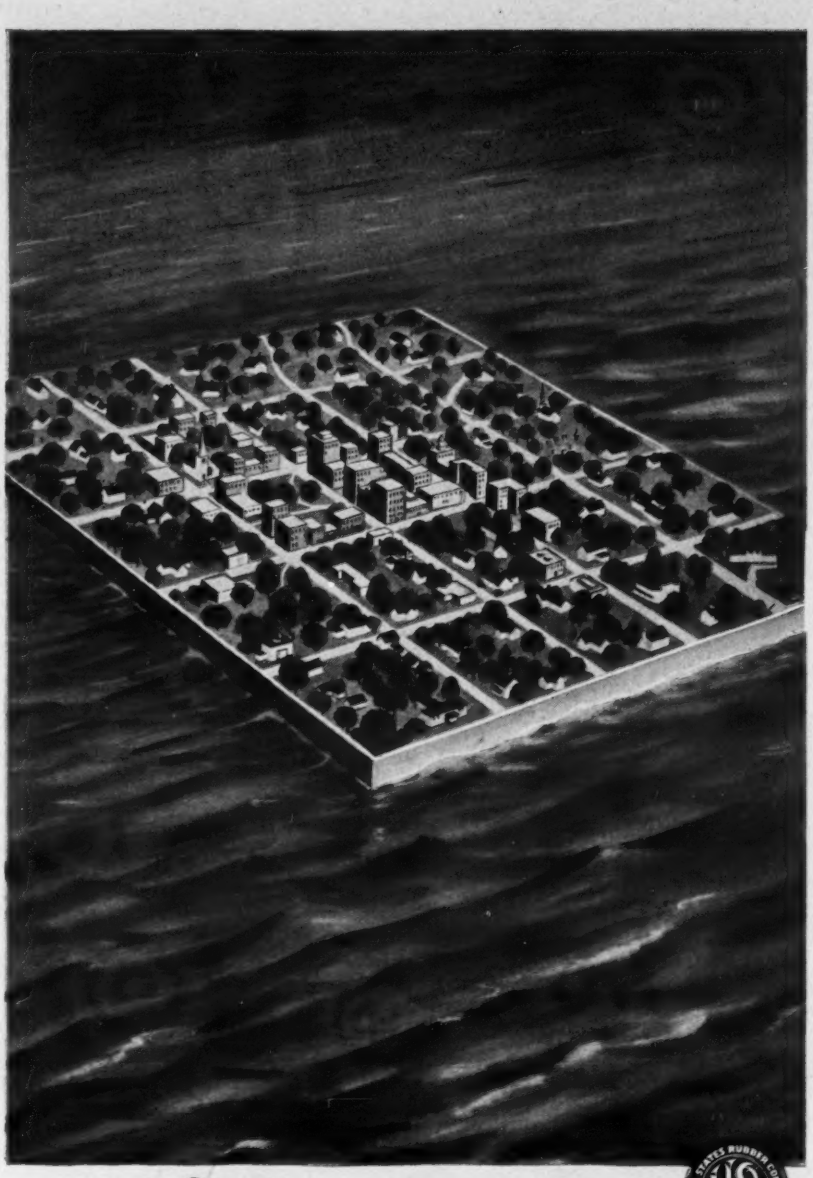
Wherever aircraft must be freed from limitations of airports, where altitude may be maintained without forward flight—and where satisfactory range and cruising speeds are also required —there Kellett looks for its postwar opportunities. Kellett Aircraft Corporation, Upper Darby (Philadelphia), Pennsylvania.



Admiral Byrd's early model Kellett autogiro at the South Pole, 1933. One dramatic service was locating a lost plane and crew, forced down miles from Little America, and directing a rescue party to the spot.

**KELLETT**

**OLDEST ROTARY WING AIRCRAFT MANUFACTURING COMPANY**



# WIRING A FLOATING CITY

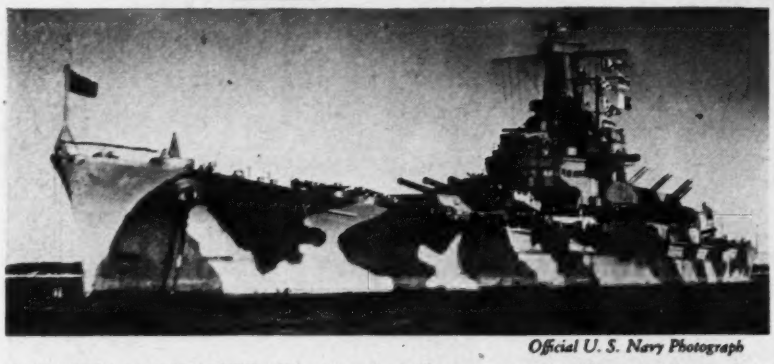
A super-dreadnaught at sea is a self-contained, highly co-ordinated community. It takes close to a million feet of insulated wires and cables for the amazing network connecting the many telephones, head-sets and loudspeakers.

Insulations of special compounds developed by U. S. Rubber scientists provide effective protection for communication and power lines. They retain their resiliency under continued vibration and the shattering shock of big guns firing.

Among these is Laytex, a compound of purified ingredients. Applied to the wire by a unique process of dipping and drying followed by vulcanizing, it forms a homogeneous sheath around perfectly centered conductors.

U.S. Laytex Wires and Cables now in combat use the world over will have a no-less important function in the communities of the future.

**Laytex WIRES AND CABLES** *SERVING THROUGH SCIENCE*



*Official U. S. Navy Photograph*

**188 MILES OF WIRE:** That's what the communications system alone on the latest super-dreadnaught requires. Laytex Wires and Cables—slender, yet tough because of their special insulation—are in use on such systems as they are elsewhere with our Armed Forces around the world. Other types of U. S. Laytex Wires and Cables are used for gun control, lighting and power.

**LAYTEX WILL COME HOME:** The entire output of Laytex Wires and Cables is still going to the Armed Forces. The day is steadily drawing nearer when manufacture of these wires and cables for Buildings, Police and Fire Alarms, Communications, Signalling, Power and Control will be resumed.

*Listen to the Philharmonic-Symphony program over the CBS network Sunday afternoon, 3:00 to 4:30 E.W.T. Carl Van Doren and a guest star present an interlude of historical significance.*

## UNITED STATES RUBBER COMPANY

1230 SIXTH AVENUE, ROCKEFELLER CENTER, NEW YORK 20, N. Y. • *In Canada:* DOMINION RUBBER CO., LTD.

# THIS CALLS FOR ACTION

# AND FAST!

*...Think how much RCA 2-Way Radio would help to get the nearest power company truck to the scene sooner!*

ONLY too well you realize what trouble and expense the community you serve would be put to if one of your power lines were suddenly broken.

Any system you can install that can help you reestablish service more quickly is essential to the public.

RCA 2-Way Emergency Radio installed on your trucks, and in your shops and offices, can enable you to get into instant touch with every one of your trucks, no matter where they are—enable you to locate at once which is nearest the scene of trouble—get it started on the job of restoring service.

You realize, of course, that today RCA factories are busy on war work. Therefore we cannot supply you with such equipment immediately. Nevertheless, you should act *now* to plan such an RCA system—and be all set for an efficient postwar RCA installation.

BUY MORE WAR BONDS

## RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION • CAMDEN, N. J.

LEADS THE WAY.. *In Radio.. Television.. Tubes.. Phonographs.. Records.. Electronics*

# INDUSTRY'S TASK FORCE

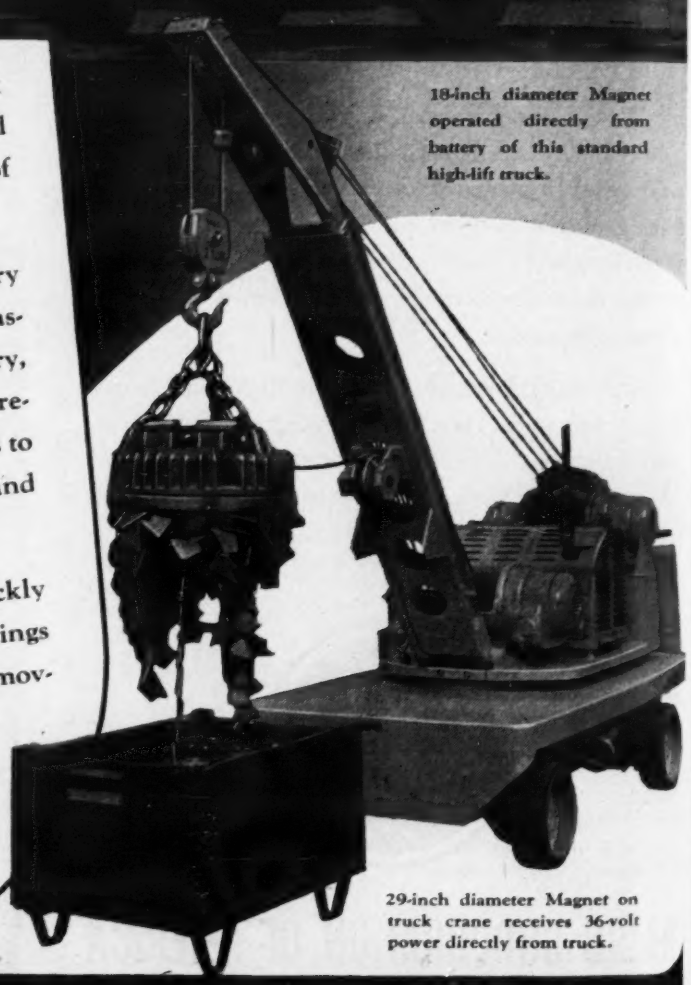
## SMALL MAGNETS on Lift Trucks

MANY plants are now using this task force of EC&M small magnets mounted on industrial trucks for a clean sweep of production lanes.

These easily handled mobile units scurry around the plant through narrow passages, into the corners, around machinery, picking up bolts, nuts, turnings, and tire-injuring scrap. They "sweep" hazards to men and equipment from the floors and save valuable materials.

They also handle plant materials quickly and at little cost, such as lifting castings and forgings from floor to machine, moving products in and out of boxcars, and other similar lifting and moving jobs about the plant.

18-inch diameter Magnet operated directly from battery of this standard high-lift truck.



29-inch diameter Magnet on truck crane receives 36-volt power directly from truck.

*EC&M Circular Magnets come in ten sizes for all industrial needs. Ask for Bulletin* **900**

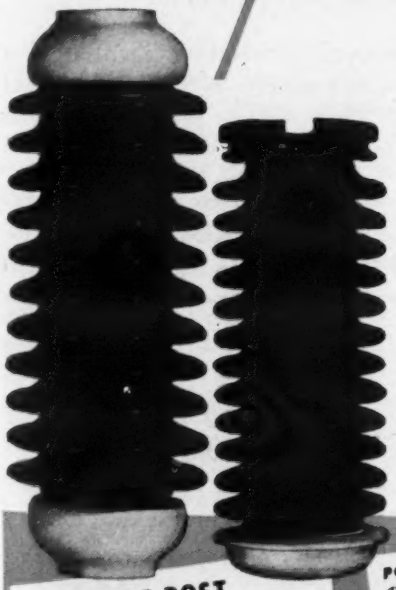
**THE ELECTRIC CONTROLLER & MFG. CO.**

2698 EAST 79th STREET · CLEVELAND 4, OHIO

# LINE CONVERSION WITH LAPP LINE POSTS

## *is the fastest way to fortify your system . . . . and uses least materials*

New or increased load demands frequently can most efficiently be handled by conversion of existing lines to higher voltage. For this job, Lapp Line Posts are particularly suited. Using present sound poles and conductors, conversion to higher voltages can be accomplished with no more than new cross-arms and Lapp Line Posts. Nor need such construction be considered as an emergency temporary expedient. Such a line approaches the current ideal for a new line; and your Lapp Posts can be expected to give trouble-free service for a longer period of years than you ever got from conventional insulators.



**LAPP LINE POST and STATION POSTS on your system offer . .**

**POWER ARCOVER.** *Flashover and leakage distances are not appreciably lowered by damage —even loss of several petticoats.*

**NO PUNCTURE.** *Puncture path in Lapp Post design is as great as flashover path. Insulator will flash over rather than puncture.*

**NO CRACKING.** *One piece post body, not subject to bursting from tension strains created by thermal changes in nested parts.*

**RADIO INTERFERENCE.** *By virtue of design factors alone, radio interference is permanently prevented at rated neutral voltage.*

**NO CLEANING.** *Fog-type design preserves uniform leakage path, prevents leakage flashover, makes the unit "self-cleaning."*

**MECHANICAL RUGGEDNESS.** *Stones or bullets deflect off, or rupture petticoats, leaving post body intact and insulator secure.*

# Lapp

**LAPP INSULATOR COMPANY, INC., LE ROY, N. Y.**

● Kappa Tapes compare with ordinary tapes *only* from the standpoint of price. Their improved electrical and physical properties definitely set them apart from previously used materials, both as to economy in production and superiority in performance.

This is not a fanciful claim. Laboratory and service tests of Kappa Tapes have disclosed characteristics seldom possessed by acceptable tapes with which they were compared . . . factors responsible for the ever increasing adoption of Kappa by electrical manufacturers from coast to coast.

When you consider that moisture absorption is ½ that of cotton, ⅓ of silk . . . that less varnish is required . . . that dry tensile strength is greatly increased . . . chance of deterioration considerably lessened . . . and flexibility at extremely low temperatures retained to a marked degree . . . you will recognize in Kappa Cellulose Acetate Woven Rayon a superior coil winding material.

- **COMPLETE IMPREGNATION**
- **HIGHER DIELECTRIC**
- **LESS VARNISH BUILD-UP**
- **FEWER VARNISH DIPS**
- **SUPERIOR FINISH**

Moreover . . . breakdown voltages for varnished samples of Kappa have tested *50% higher than for ordinary tapes,* up to 10 mils (fabric plus varnish).

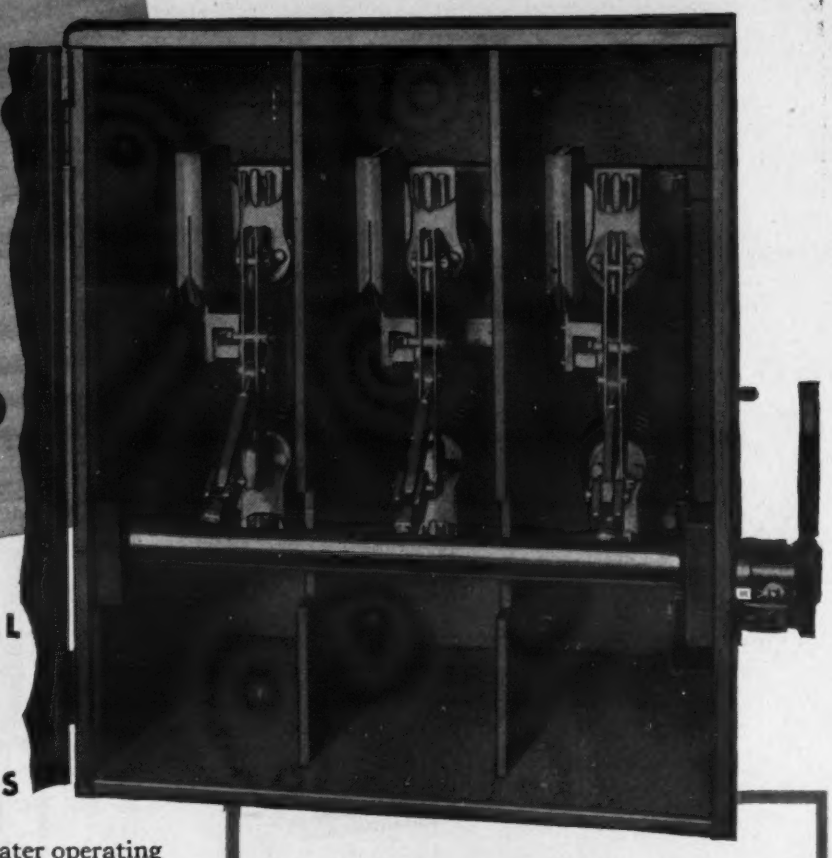
We believe these facts warrant your early investigation of Kappa Tapes. Write for full length testing samples to Wm. E. Wright & Sons Company, Industrial Textile Division, Box 1000, West Warren, Massachusetts

*Send for this factual bulletin which presents comparative test data of Kappa and ordinary tapes.*

*The Wright tape for every winding..* KAPPA

# O.K.

## TO OPEN UNDER FULL LOAD



## ...WHEN YOU INSTALL WESTINGHOUSE LCB LOAD-BREAK DISCONNECT SWITCHES

LCB disconnects can give your system greater operating flexibility because they perform a double function: (1) they isolate the connected equipment, and (2) they can be opened at any time—*even under full load.*

The quick-break auxiliary blade, with its "De-ion" arc chamber, insures only "dead" switching on the main contacts. As a result, the switch can handle hundreds of operations without maintenance.

The LCB switch is designed for indoor installations and is group-operated. Suitable enclosures are available to meet all requirements. Combinations include mounting with BA power fuses for fused protection.

For complete information, call your Westinghouse office or write for B-3203, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N.

J-60548

**RATING TABLE**

| Switch Rating Continuous | | System Voltage | Interrupting Rating Amperes |
|---|---|---|---|
| Amperes | Volts | | |
| 400 | 5000 | 2400<br>4160 | 400<br>400 |
| 200 | 7500 | 6900 | 200 |
| 100 | 15000 | 13800 | 100 |

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

**DISCONNECT SWITCHES**

### HOW IT WORKS

**1. Closed . . .** practically all current flows through main blade, small current through "quick-break" blade.

**2. Main blade opens . . .** all current momentarily flows through "quick-break" blade, which is held tightly.

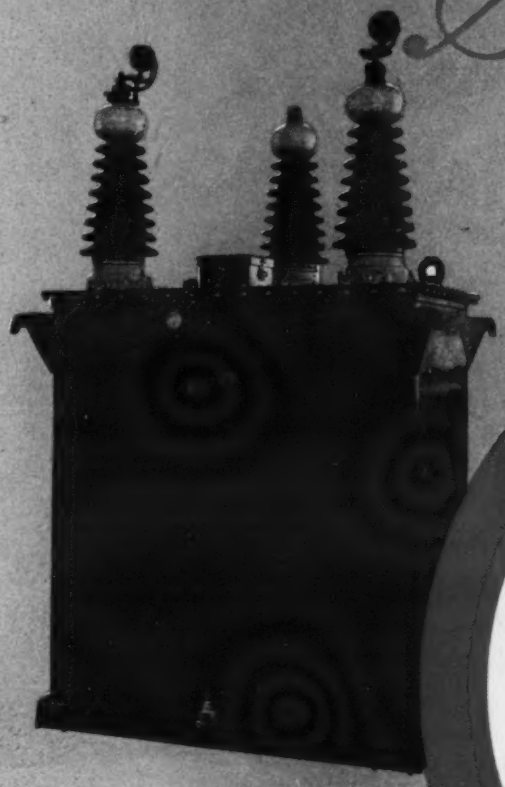
**3. "Quick-break"** blade snaps open. Arc is stretched in "De-ion" chamber and instantly quenched.

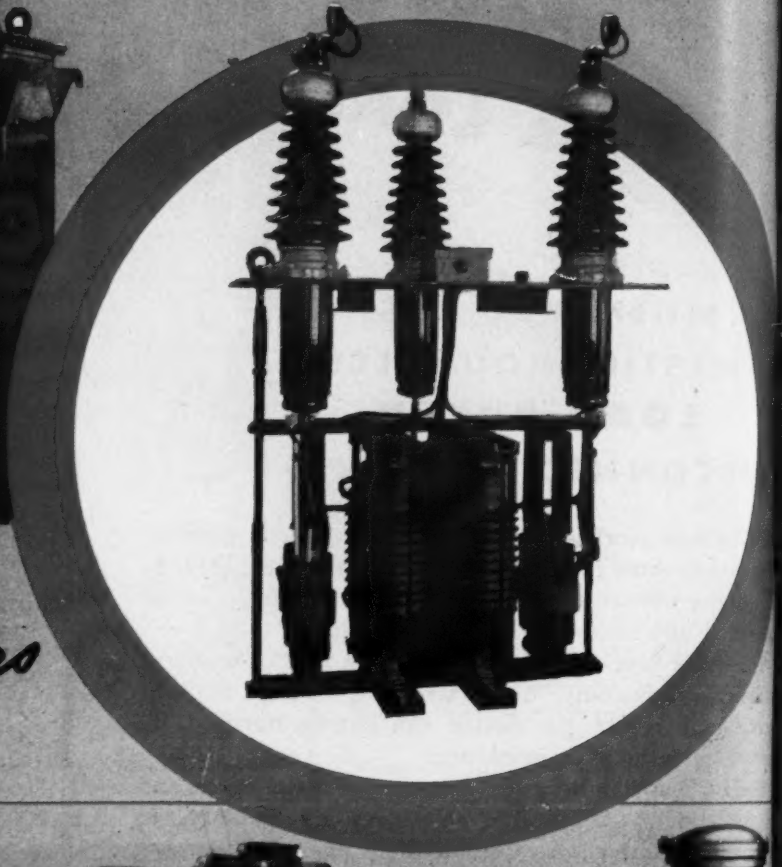
# Standard

TRADE MARK

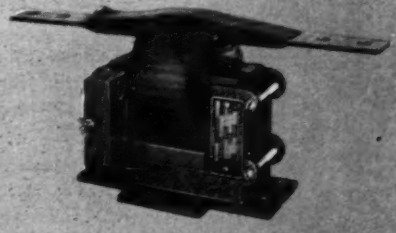
## Outdoor, Oil Immersed Metering Set

Consists of two Current and two Potential transformers mounted in an oil-filled steel tank. Shown here is the coil and core structure, also the complete set.

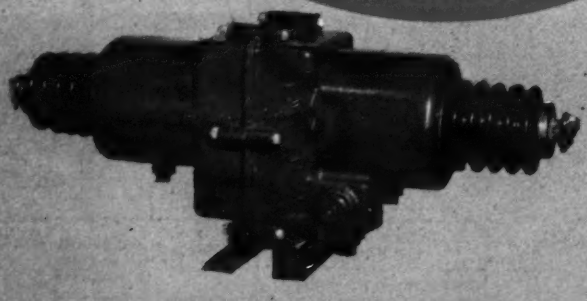




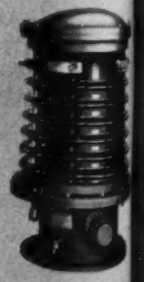
## Current Transformers



For highest accuracy Standard type NA Current Transformers are used. Accuracy exceeds highest NEMA standard. Indoor service.



For outdoor service where high accuracy and dependability are required, the type CR transformer will give complete satisfaction.



This unusual, weather-proof Current Transformer is porcelain housed. Type CW for 46,000 volt service.

For Every Class of Service

# THE STANDARD

Distribution and Power · Current and Potential · Askarel Cooled

# INSTRUMENT TRANSFORMERS

## *Current Transformers*
## *Potential Transformers*
## *Metering Sets*

Meeting your most rigid requirements for accuracy and dependability, Standard Current and Potential Transformers and Metering Sets are made in many sizes and types to suit various service requirements.

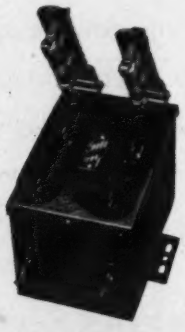
Current Transformers include types for indoor or outdoor use, in degrees of accuracy called for by requirements of the service, and for system voltages up to 69,000 volts (outdoor) and 15,000 volts (indoor). Liquid filled or air cooled dry type.

Potential Transformers are manufactured in sizes up to 69,000 volts (outdoor) and 13,800 volts (indoor). Liquid filled and dry types.

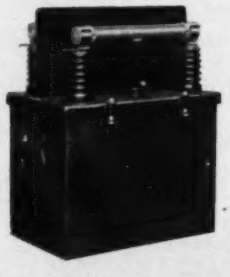
Standard Metering Sets provide primary metering service at considerable saving of space and cost. Made for outdoor service, for all voltages up to 69,000 volts, inclusive.

All Standard Instrument Transformers reflect years of experience and engineering skill in their design and construction. Users everywhere have found these Standard units accurate and dependable.

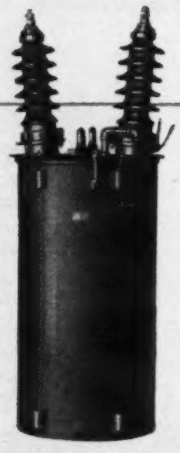
## *Potential Transformers*



Type P Potential Transformers provide highest grade instrument or metering service. This type is for 2400 volts and below.



Standard Type P Transformer for 6,900 to 13,800 volt service. Both ratings are furnished with or without primary fuses.



Typical oil-filled Standard Outdoor Potential Transformer. For service up to 69,000 volts. Air cooled in lower voltage class.

**WRITE FOR ILLUSTRATED DATA BULLETIN**

**TRANSFORMER CO.** WARREN, OHIO.

ural · General Purpose Dry Type · Auto Transformers · Street Lighting

★ ★ WAGNER PRODUCTS FOR VICTORY ★ ★

Wagner Unit Substations are doing their part in the production of steel, synthetic rubber, oil and other vital materials.

# Wagner
## UNIT SUBSTATIONS
### PROVIDE LOAD CENTER CONTROL FOR LIGHTING AND POWER CIRCUITS

*The Unit illustrated above is installed in a synthetic rubber plant.* Each transformer has a two-position liquid-filled disconnecting switch on the high-voltage side which is equipped with low-voltage interlock. The low-voltage side is equipped with air circuit breakers electrically or manually operated, ground indication lights, voltmeters, ammeters, and ammeter test blocks. Each unit has one main breaker, one tie transfer breaker, and two feeder breakers.

MOTORS
TRANSFORMERS
UNIT SUBSTATIONS
INDUSTRIAL BRAKES
BRAKE LINING

*For Complete Information* on Wagner Unit Substations write or phone the nearest Wagner branch office.

ARMY E NAVY

NATIONAL SECURITY AWARD

BACK THE ATTACK—
BUY U. S. WAR BONDS

T44-3

Wagner Electric Corporation
ESTABLISHED 1891
6456 Plymouth Avenue, St. Louis 14, Mo., U. S. A.
ELECTRICAL AND AUTOMOTIVE PRODUCTS

# SAVE METAL

## *BY USING*

# ALL PORCELAIN LIDS

## ON INDOOR HIGH VOLTAGE POTHEADS

# G & W TYPE "P"

*The insulated cable conductors are brought out through the three holes in the all-porcelain lid—without using any copper connectors. The lid holes have extensions which permit tape sealing the separate conductors to the porcelain.*

**SHAPE "C"**
*(With stuffing box and conduit coupling.)*

**COMPLETE DATA FOR ORDERING IS GIVEN BELOW**

**SHAPE "K"**
*(With wiping sleeve.)*

**SHAPE "U"**
*(With "CR-SB", combination clamp ring and stuffing box.)*

### 6600 Volts Indoor—600 Volts Outdoor

Type "P" potheads are made in three shapes. The porcelain lid has three holes of ⅞ in. diameter and will take any sized conductor that will pass through. Two holes have keyways or slots for venting air while filling with compound.

The center hole in lid can be plugged for use with 2-conductor cable.

| Max. Dia. Cable | | CATALOG NUMBER | LIST PRICE | Body | | Approx. Shipping Weight Lbs. | Approx. Comp'd Req'd Gallons |
|---|---|---|---|---|---|---|---|
| Wiping Sleeve | "CR-SB" or "SB" | | | Shape | Symbol | | |
| 2¼" | 1¾" | AP3523C | $12.00 | C | P3C | 16 | ¾ |
| 3¼" | 2¾" | AP3524C | 15.00 | C | P4C | 20 | ¾ |
| 2¼" | 1¾" | AP3523K | 18.00 | K | P3K | 25 | ⅝ |
| 2¼" | 1¾" | AP3523U | 18.00 | U | P3U | 25 | ⅝ |

*Filling compound not included in above prices. Add 10% list.
Conduit couplings and armor clamps extra—Up to 2½"—$1.50. Up to 4"—$3.00 List.

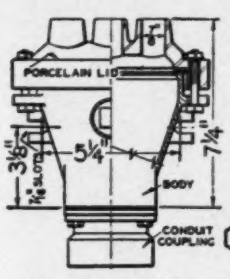



*Fig. 87—Shape "C"*

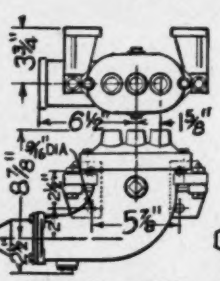



*Fig. 88—Shape "K."*

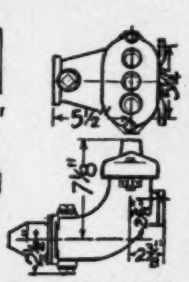
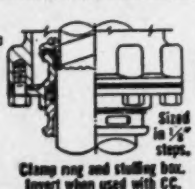



*Fig. 89—Shape "U."*

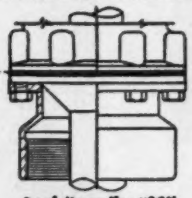
CABLE ENTRANCE FITTINGS IN STANDARD STYLES SHOWN BELOW. SPECIFY STYLE WANTED. BE SURE TO GIVE CABLE DATA AND CONDUIT SIZE.

Wiping Sleeve—"WS"

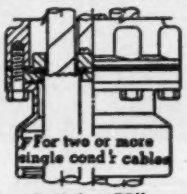


Clamp ring and stuffing box. Invert when used with CC. Sized in ¼" steps. Symbol—"CR-SB"

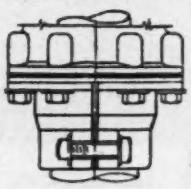
Plain stuffing box. Can be drilled on job to cable size. Uses cord packing. Symbol—"SB"



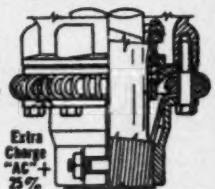
Conduit coupling "CC"



For two or more single cond'r cables. Symbol—"PB"



Armor clamp "AC"

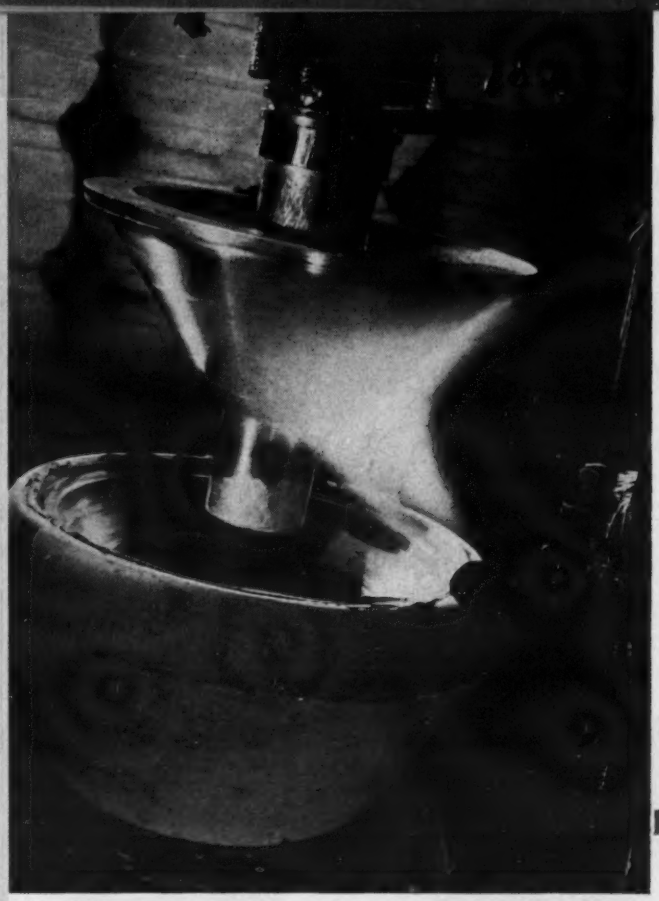


Extra Charge "AC"+ 25% Wire armor clamp—"WAC"

*Send for Bulletin 392 for complete data on other types of G & W POTHEADS.*

**G & W ELECTRIC SPECIALTY CO.**
**7780 DANTE AVENUE • CHICAGO, ILLINOIS**
*In Canada—Powerlite Devices, Ltd., Toronto, Ont.*

POTHEADS . . . BOXES . . . OIL FUSE CUTOUTS . . . OIL SWITCHES AND MULTIPLE CIRCUIT OIL DISCONNECTS



# What's behind

## PINCO INSULATORS

The shaping of an insulator to line needs takes engineering knowledge, technical skill and precision craftsmanship.

This is a third in a series of advertisements showing how insulators are made by the wet plastic process in which all forming operations are performed with the clay in *plastic* form.

Write for your copy of the Pinco Catalog showing Pinco Standard Insulators and Hardware.

*Pinco Standard Insulators are cataloged in the Electrical Buyers Reference.*

**15.** The clay blank after being shaped by hand is placed in the plaster of paris mold, then put in the hot press where the inside contours are formed by a heated metal plunger revolving in one direction only. Here a pressure of 40,000 pounds per square inch is exerted. The combination of heat, the carefully engineered contour of the plunger, and the one direction rotation insure proper clay flow and accurate shaping without setting up stresses and strains in the porcelain.

**16.** Hand jiggering is an operation requiring a high degree of skill and long experience. Here the operator using a carefully cut profile, applies pressure through the lever arm to form large and intricate shapes.

**17.** Roll threading is a patented Pinco process which produces a highly accurate pin fit. The hole is formed first by the hot press method. The threads are then *rolled* into place, producing a much more accurate pitch and taper than by other methods.

Suspension Insulators . . . . Switch & Bus Insulators . . . . Distribution Pin Types and Guy Strain . . . . One Piece & Multi-part High Voltage Pin Types . . . . Suspension & Strain Clamps . . . .

# "RIGHT on the job" service

**18.** After the forming operations have been completed the porcelain insulator shells are allowed to remain in the plaster of paris mold, the plaster absorbing enough of the moisture from the clay to permit handling in a short period of time.

**NOTE THE BEADED EDGE.** All Pinco Insulators are made with a beaded edge, a method of construction which was first introduced by Pinco in 1921. It gives an inherent ruggedness, resistance to breakage in handling and withstands mechanical shock after installation.

Pinco
1060

**19.** Right from design through fabrication and all steps of the process resistance to impact is so carefully *planned* for and executed that even *unglazed* Pinco Units have exceptionally high impact resistance values, which are still further increased by proper glazing.

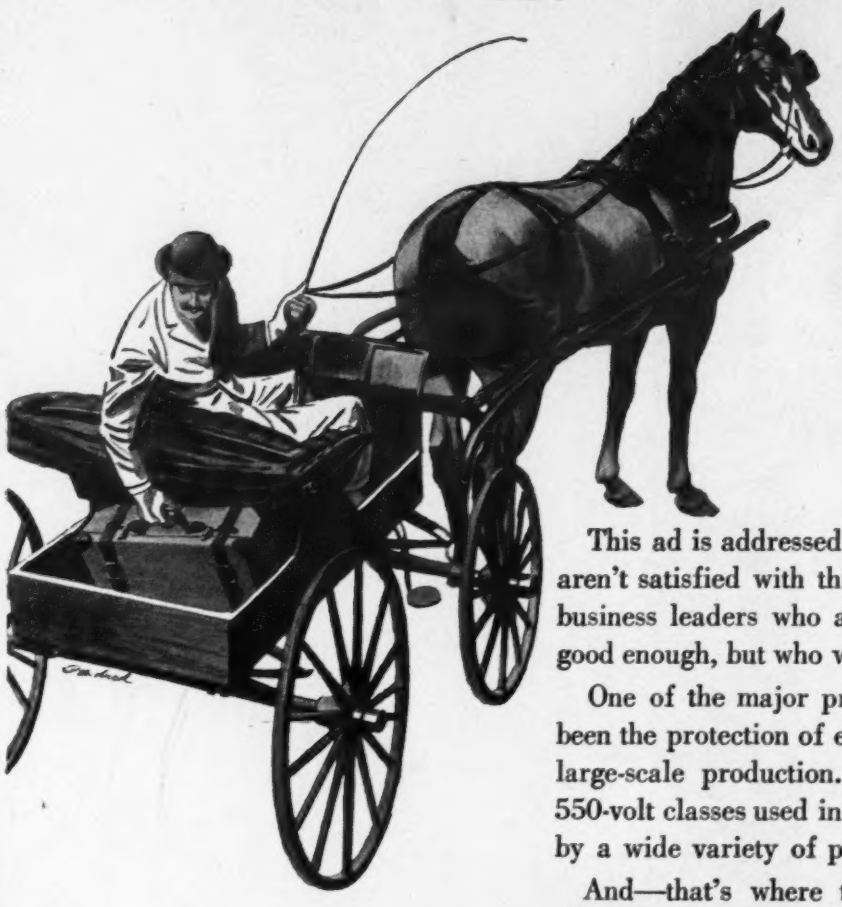
## The Porcelain Insulator Corporation

**653 Main Street, Lima, New York**

**SALES AGENTS**—JOSLYN MFG. & SUPPLY CO., Chicago 6, Ill.; Kansas City 16, Mo.; Monticello 2, Ind.; Omaha 4, Neb.; Springfield, Ill.; The Joslyn Company, New York 5, N. Y.; Baltimore 25, Md.; Philadelphia 2, Pa.; Richmond 21, Va.; Rochester 10, N. Y.; Washington 8, D. C.; South East Joslyn Co., Cincinnati 7, Ohio; Atlanta 3, Ga.; Cleveland 13, Ohio; Jacksonville, Fla.; Lexington, Ky; Jobbers Supply Company, St. Paul 4, Minn., Portland 9, Ore.; Seattle 4, Wash.; Southern Joslyn Co., New Orleans 19, La.; Joslyn Southwest Co., Dallas 1, Tex.; Houston 4, Tex.; Joslyn Co. of California, Los Angeles 11, Calif.; San Francisco 3, Calif.; H. E. Burns, Pittsburg, Pa.; Paul A. Douden Co., Denver 2, Colo.; Paul Carson, Amarillo, Tex.; J. J. Costello, Boston 16, Mass.

Distribution Clamps . . . . Transmission Line Fittings . . . . Transformer & Circuit Breaker Bushings . . . . Indoor Bus Support Porcelain . . . . Tree Insulators . . . . Lightning Arrester Porcelain

# IF you're satisfied to travel by horse and buggy... or shave by candlelight



don't read this ad

This ad is addressed to those men in American industry who aren't satisfied with things that are merely "adequate" . . . to business leaders who aren't content with devices that are just good enough, but who want something a bit better than the best.

One of the major problems of modern industry has always been the protection of electrical circuits essential to continuous, large-scale production. These circuits (in the 220, 440, and 550-volt classes used in every plant) have been and are guarded by a wide variety of protective devices.

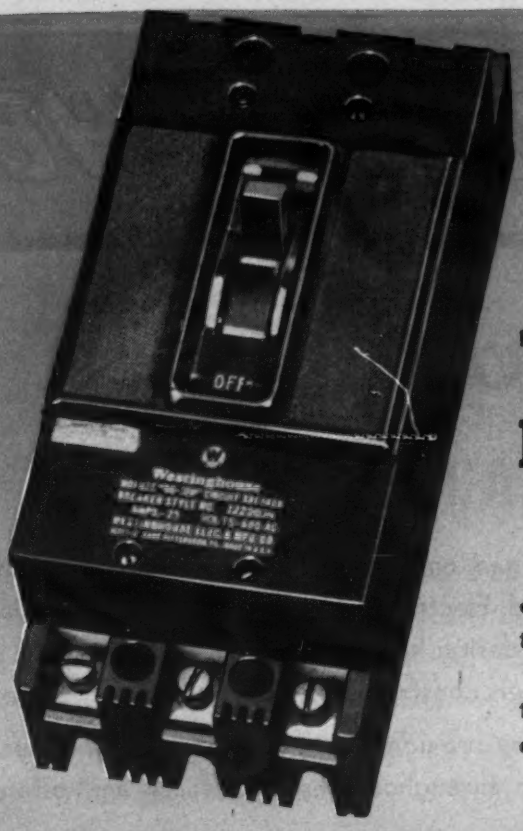
And—that's where the horse and buggy and shaving by candlelight come in. For, most of these devices—while affording adequate protection—are as out of date as Dobbin and the old straight-edge.

They do the job—there's no doubt about that! But, how do they do it? Are they efficient? And—how much do they cost? . . . These are questions to which every businessman should demand definite answers.

And, gentlemen, if you don't insist on the horse and buggy, here are your answers. J-60557

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE




# There's only one modern method of Circuit Protection

# The "DE-ION" (fuseless) CIRCUIT BREAKER of 1944 . . . . .

This breaker is as far ahead of ordinary circuit protective devices as is tomorrow's streamlined car by comparison with the old high-wheeled buggy.

And—when compared with previous breakers, it justifies the analogy of the modern fluorescent light and the first carbon bulb.

## Here's what the "De-ion" (fuseless) Circuit Breaker of 1944 offers to industry:

**1. Provides positive "plus" protection** of productive circuits . . . the same protection that controls circuits on modern battleships . . . where failure may mean defeat.

**2. Permits maximum loading** of circuits . . . will not interrupt circuits on harmless momentary overloads . . . prevents many work stoppages and delays . . . completely eliminates need for replacement of protective devices or parts thereof.

**3. Assures faster resumption of interrupted service** after causes of overloads or short circuits are removed. There is nothing to replace or repair—to restore service, simply throw the handle. This feature alone saves American industry more than one million man-hours yearly.

**4. Guarantees safe operation.** Working parts are completely enclosed and sealed. These breakers are the safest protective devices ever built. They are absolutely tamperproof (cannot be bridged or blocked by pennies, nails or other foreign articles).

*and* **5. The lifetime cost of the "De-ion" (fuseless) Circuit Breaker of 1944 is less than that of any other protective device.** Ask any Westinghouse representative for facts and figures. Westinghouse Electric & Manufacturing Company, Dept. 7-N, East Pittsburgh, Pa.

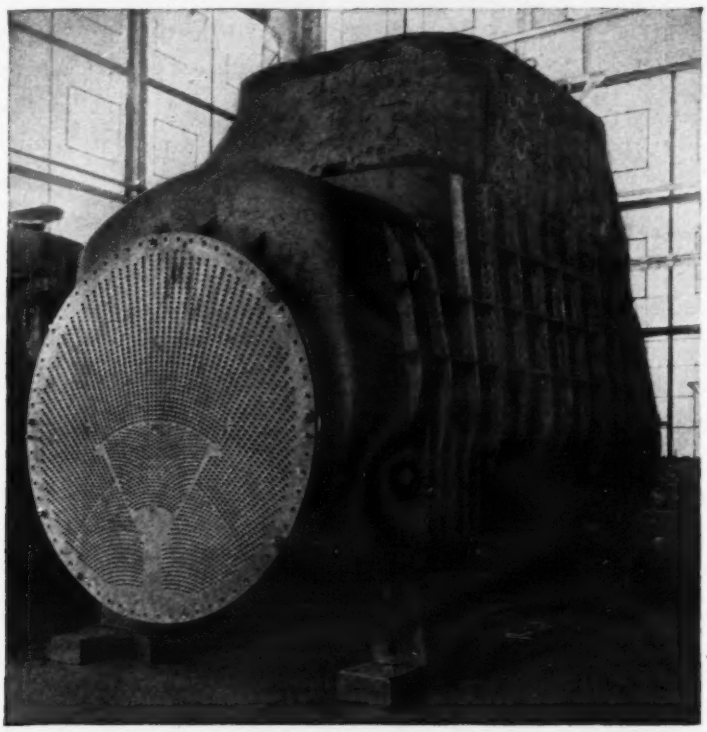
## "DE-ION" (*fuseless*) CIRCUIT BREAKERS

# Blazing THE Condenser

## RADIATING TUBE ARRANGEMENT

★ In 1924 the first condenser with tubes arranged on radiating straight lines was put into operation at the plant of the Rockford Electric Company, Rockford, Illinois. Since then, this fundamental improvement in design has gained wide acceptance . . . and is used in more than one thousand condensers constructed by Foster Wheeler alone.

Steam lanes of uniformly decreasing area are provided between the rows of tubes. This design effects a high rate of heat transfer throughout the condenser and offers minimum resistance to steam flow.



First condenser designed and constructed with tubes arranged on radiating straight lines.

Foster Wheeler is a Four Star Winner under the U.S. Navy Board of Awards for production.

**FOSTER WHEELER CORPORATION**
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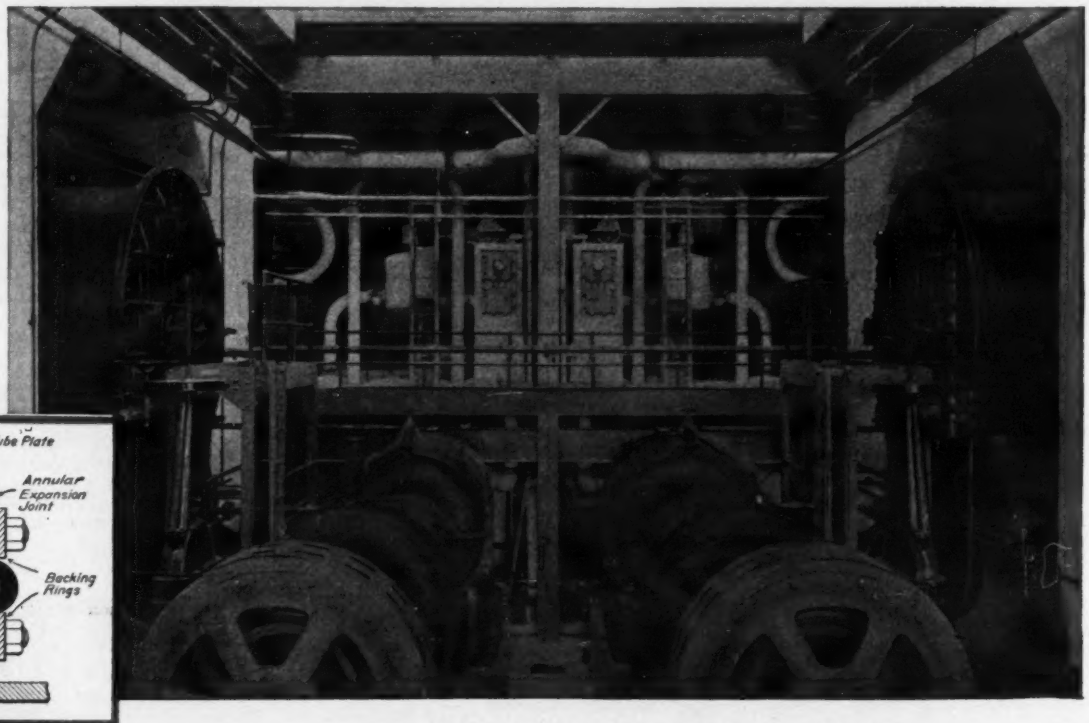
# ENGINEERING TRAIL

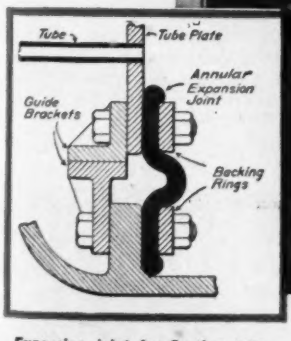
# Development

## EXPANDED TUBES

★ The first surface condenser to have all tubes expanded into tube sheets at both ends was designed and built by Foster Wheeler twenty-one years ago for the Texas Power and Light Company, Trinidad, Texas. This construction insures permanently tight joints to eliminate contamination of condensate by the circulating water.

Performance of this installation was so eminently satisfactory, showing far greater purity of condensate than obtained from other designs, that the principle of expanding condenser tubes at both ends has since become a standard practice.






Expansion joint for floating tube sheet condensers used in the Trinidad units and in many of today's designs.

Condensers of the Trinidad Station of Texas Power and Light Company were the first to have all tubes expanded into tube sheets at both ends.

WHEELER FW

# *RAPID-READING ROLLCALL of Irvington INSULATING Materials*

Here is a quick over-all glimpse of Irvington's service to electric light and power companies, large power users and electrical manufacturers.

What you see and read on this page merely highlights the many Irvington products currently available. Detailed product information to round out the picture will be sent on request.

What cannot be shown is the knowledge behind each product — the continuous and expanding research aimed at product improvement and development of new materials to meet the changing needs of industry.

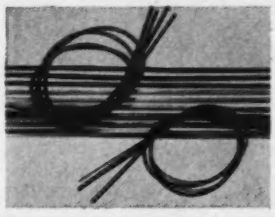
Irvington products — and the recommendations of Irvington technicians—have supplied the answer to many insulation problems. Enlist the assistance of both, today. Write *Irvington Varnish & Insulator Co.*, Irvington, New Jersey, Dept. 46.

## PLASTIC TUBINGS

Flexible extruded plastic tubings with excellent electrical and physical properties, suitable for use over a wide range of temperatures. Special types with low power factor for h. f. applications, such as Styraloy and Polyethylene.

## VARNISHED TUBINGS

A complete line of flexible varnished tubings, meeting VTA and ASTM Standards, and including saturated sleevings, radio spaghetti, and varnished Fiberglas tubings and sleevings.



## OIL STOP

Applied as a viscous liquid, Harvel Oil Stop hardens to an infusible, non-thermoplastic state; is used in making splices, stop joints and oil-tight cable terminals.

## VARNISHES

A full range of insulating varnishes answering both ordinary and many special requirements. Catalog H2 describes each type in detail.

## VARNISHED CAMBRIC

Widely used Irvington Varnished Cambric and Tape are obtainable in either black or yellow, in Straight-Cut or Seamless Bias form, and in a choice of several finishes.

## ALTERNATES FOR VARNISHED SILK

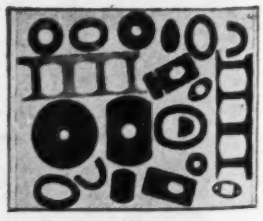
Include Yellow Varnished Nylon, Yellow Varnished Rayon, and thin Varnished Cambric, Style SIC. The last is available in black or yellow and can be furnished in continuous length rolls in Seamless Bias or Straight Cut form.

## VARNISHED PAPERS

Range extends from thin condenser tissues and 100% rag to Kraft papers. All types are highly resistant to heat, oil and moisture.

## PUNCHINGS

Fabricated pieces of Varnished Cambric, Canvas, Paper, Slot Insulation, etc. Dies available for many useful shapes; dies for special shapes constructed to specifications.



**IRVINGTON VARNISH & INSULATOR COMPANY**

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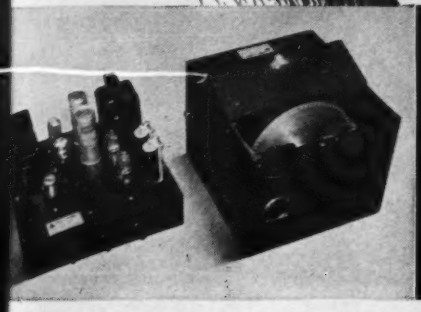
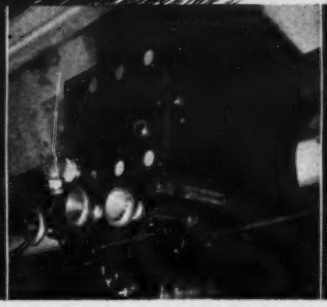
Plants at Irvington, N. J. & Hamilton, Ontario, Canada • Representatives in 20 principal cities

# HOW AN RCA ELECTRON TUBE SAVES PAPER



Scanner and Amplifier convert light reflections into faint electric impulses and amplify them to control position of paper during color printing. Equipment developed by Research Laboratories of ALCO GRAVURE and produced by Morrill & Morrill.



Scanner head mounted at the press rollers. Its "magic brain" consists of 12 RCA Electron tubes: a 929, 6J7, four 6SJ7's, a 6H6, 6SN7-GT, two 2050's, a 5Y3-GT, and a 6X5.

COLOR printing that's "out of register" has caused many a reader to frown...many a publisher and printer to reach for the aspirin.

The picture of the War Bond poster shown above was purposely printed improperly... to illustrate what printers call "out of register." The term means that the impressions of two or more printing plates do not fit together as they should.

It takes patience and great skill to adjust color presses accurately *by hand*. And a considerable amount of paper is usually wasted in the process, because the adjustments must be made while the presses are running.

ALCO GRAVURE, of Hoboken, N. J., has solved this problem... by electronics.

While the first color is run off, positioning dots are simultaneously printed on the edge of the paper. As the paper is fed through the rollers for each subsequent color application, a sensitive RCA phototube scans the edges of the paper, picks up the light variation reflected by the dots, and instantly converts these reflections into tiny electric impulses. These are immediately amplified by another set of RCA tubes, and used to control the position of the paper with respect to the rollers.

This electronic device, first installed by ALCO GRAVURE several years ago, resulted in far more precise color registry than was formerly possible by hand...and has saved many tons of paper per press per year.

RCA electron tubes are destined to play an increasingly important part in industry...for measurement, counting, weighing, control, high-frequency heating, and an almost limitless variety of other purposes. If you believe that electronics can do some job better, faster, more accurately, or cheaper than is being done in your plant today, and will write to us about your specific problem, we will gladly refer you to the equipment manufacturer best fitted to serve you. Or our own engineers may be able to help. *For the Magic Brain of all electronic equipment is a Tube...and the fountain-head of modern Tube development is RCA.*

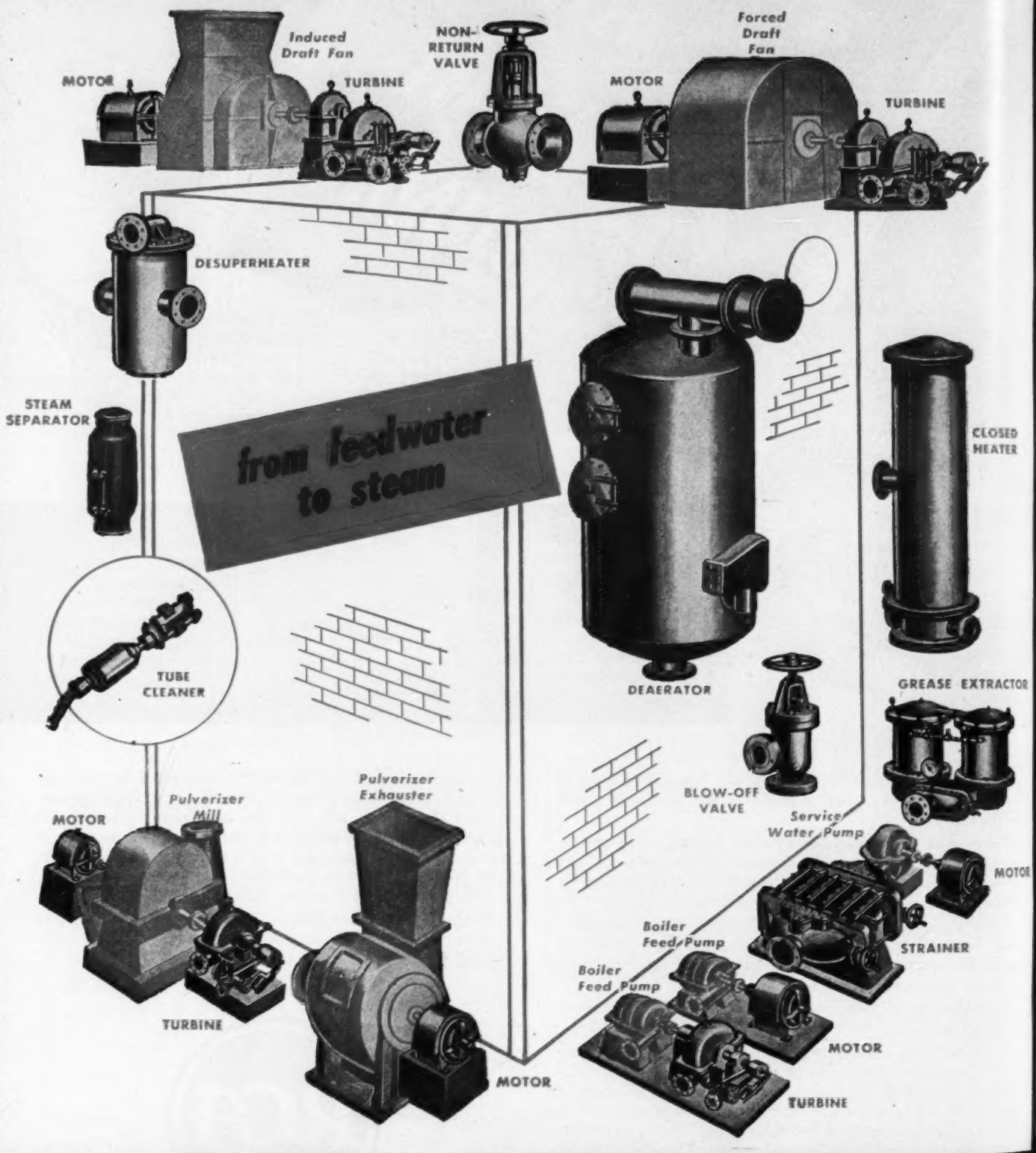
Meantime, may we mail you our 32-page, color-illustrated, free booklet "*Electrons in Action at RCA*"? Simply write RCA, Commercial Engineering Section, 618 South 5th St., Harrison, N. J.

RCA

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION • CAMDEN, N. J.

# ELLIOTT -- from boiler

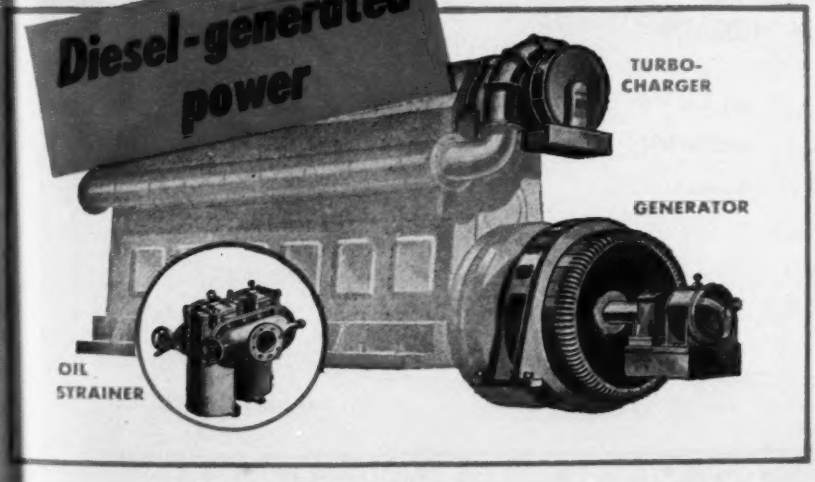



# ELLIOTT

# feed to generated power

## from steam to kilowatts

## Diesel-generated power




On these two pages we picturize the varied equipment essential to put power-on-the-line. There's a lot of it — and a surprisingly large number of these units, (shown in full tone) is being built by Elliott Company.

Some of this equipment, the smaller units particularly, is pretty well standardized, being built on Elliott designs developed through years of practical service. Some, however, such as turbines, generators, larger motors, etc., are designed and built for the specific conditions under which they must operate. How well these conditions are met is attested by the confidence of power plant engineers in equipment with the Elliott mark.

There is nothing dramatic about dependable operation. But there *is* continuous and predetermined profit. That is the element which dominates in all Elliott equipment.

ARMY-NAVY "E" ARMY-NAVY "E"

Q-1107

# Company

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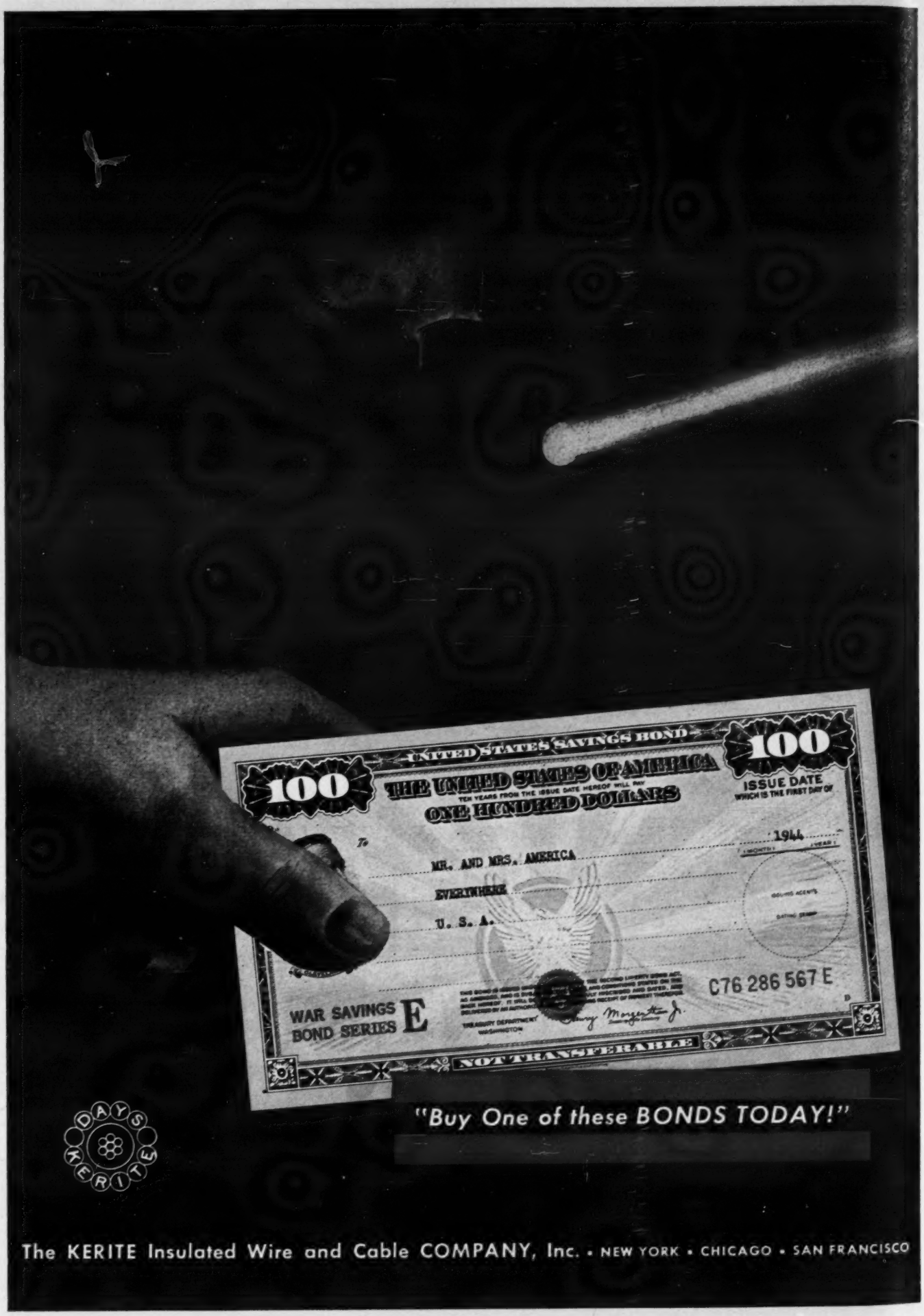
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Electrical World

JUNE 24, 1944

# Medals for Valour

THE ELECTRICAL INDUSTRY recognizes meritorious achievement by several different awards. Not all are given each year but there are the Edison and Lamme medals of the American Institute of Electrical Engineers, the four medals under the James H. McGraw Award, the awards made at the time of the annual convention of the Edison Electric Institute and this year a new medal to be awarded for the first time by the Illuminating Engineering Society.

Medals are awards for valour. Just as many of our young men who are fighting the enemy are decorated for brave deeds, so do we honor men for their courage—not for physical intrepidity but for mental daring.

Because we honor our scientific, engineering and business heroes only after the battle has been won and we are able to weigh the merits of the achievements dispassionately, we lack the emotion that accompanies a decoration on the field of battle.

That is unfortunate because an award is made not only as a recognition for courage but also as means for inspiring others to exert themselves beyond the line of duty. The awarding of a medal or a prize, therefore, should not be regarded as the closing of the record of some splendid achievement so much as the opening of the gates of imagination.

The electrical industry needs inspiration of this kind. Opportunities are greater today than ever before because the problems are more numerous. Yet the romance that was ours a quarter of a century or more ago has been dulled. We must restore it if we are to attract to this industry the young men whose desire is to create.

What is it that this industry had at the end of the last war that it hasn't got today? What was it that then stimulated the imagination of youth that is lacking today? Then we were a young industry with seemingly boundless opportunities to serve mankind in ways that were better. Has that vision narrowed any? Surely it must be expanding more rapidly than ever if it took from 1882 to 1936 to reach the first hundred billion kilowatt-hour output and less than seven years more to reach the second hundred billion.

Is the need for engineering any less? No, in fact it never was greater. We see the practical possibilities of new sources of generation, we are flirting with d.c. transmission, we have a problem in distribution economics that will tax the keenest minds, we see new uses, the possibilities of which are breath-taking.

If these things are so, why aren't the young men aware of them? The answer lies with those in the industry. How much of the future comes within their vision? How much do our present leaders see? Are they perhaps prone to gaze more fondly upon the glories of the past than upon the opportunities of the future? Do they take more pleasure in looking back upon their own contributions than upon those which new generations can make?

Today we should be painting pictures for tomorrow's medalists. We should be stimulating the thinking of our future industrial heroes. The seeds of the next generation's awards will be planted now. How good the crop will be depends upon how well we now prepare the soil.

# Detroit Edison's New Chairman

***Prentiss Brown brings into the electric utility business, a keen perception of the importance of good public relations and a capability in politics that should make him a valuable addition to the industry***

***FRANK R. INNES, Managing Editor, "Electrical World"***

WHAT IS Prentiss Brown, former Senator and OPA head, now chairman of the board of the Detroit Edison Co., bringing into the electric utility business? What is he going to do? Does the word "politics," heard on all sides when the news broke of his selection, fit the case?

Exactly one week after his election by the Detroit Edison board ELECTRICAL WORLD sought an interview with Mr. Brown. The notice was short because the occasion was fortuitous. Mr. Brown could have begged off easily; he might have been unable to find the time; he might wish to avoid publicity until he became more familiar with his position and its demands; he might have used any of a number of excuses, all of them good, to refuse the interview. But he did not. The engagement was made with astonishing ease, the only stipulation being that he should not be directly quoted in publication so soon, the interviewer to report only his own impressions.

There, as well as it can be stated by an outside observer after Mr. Brown's first week in office, is the answer to the first question. Fuller answer will come with time as the new chairman develops his policies and they appear in statement and in action. At the moment, however, it can be said that Prentiss Brown is bringing into the utility business a mind that recognizes the interests of others, that does not shy away from publicity and that is wise to avoid attributable statement at such an early date.

What is he going to do? In a statement to the Detroit newspapers, Mr. Brown said his knowledge of the character and purpose of the Detroit Edison Company has led him to the conclusion that no changes in general policy are advisable. The organization, he said, is seasoned and experienced, is of a splendid loyalty and devotion to service. But such words are no more than to be expected of the man and the occasion. For more definite information on what Mr. Brown will do in the utility business, recourse must be had to the impressions received by the interviewer which, of course, may be mistaken although past events support them.

### *Favors Speaking Out*

Heavy reinforcement is on the way to that group of electric utility men who believe that you've got to tell people what a good job you're doing if you want to get any credit for it. That was the principal impression the writer got from the man who now sits in Alex Dow's place at the head of one of the nation's largest public service companies. He thinks that the people do not know what the electric utilities are and the part they play in the life of the community. Obviously, Mr. Brown will do what he can to correct that condition.

Probably this conclusion about Mr. Brown could have been arrived at without calling on him. A man does not win success in law, in banking and in politics by standing mute. He does not wait for other men to take the trouble to inquire how capable he is. No, he tells them and if he actually is capable he gets to be a member of the United States Senate or he reaches any other eminence at which he aims. Morover, such a man knows where to put the emphasis on what he tells. He acts instinctively on that maxim of Rochefoucauld, "The gratitude of most men is but a secret desire of receiving greater benefits." Thus he does not spend all his time telling what he has done for those whose regard he seeks; instead he plays up what he is doing and will do and says little or nothing about what is past and done with, finished, ended.

Seeing and talking with Mr. Brown perhaps did no more than deepen an impression already registered. Certainly the visit did nothing to remove or change that impression. Which is why we say again that the "tell all" faction among electric utility executives will, at no very late date, welcome into its midst a strong recruit. Definitely Mr. Brown realizes from his heretofore objective and disinterested thinking, and he will realize even more strongly now that he has become a heavily interested party, that the electric utility industry has suffered, still suffers, from a sort of congenital introversion that can be corrected only by cultivation of the opposite characteristic.

### *In Good Hands*

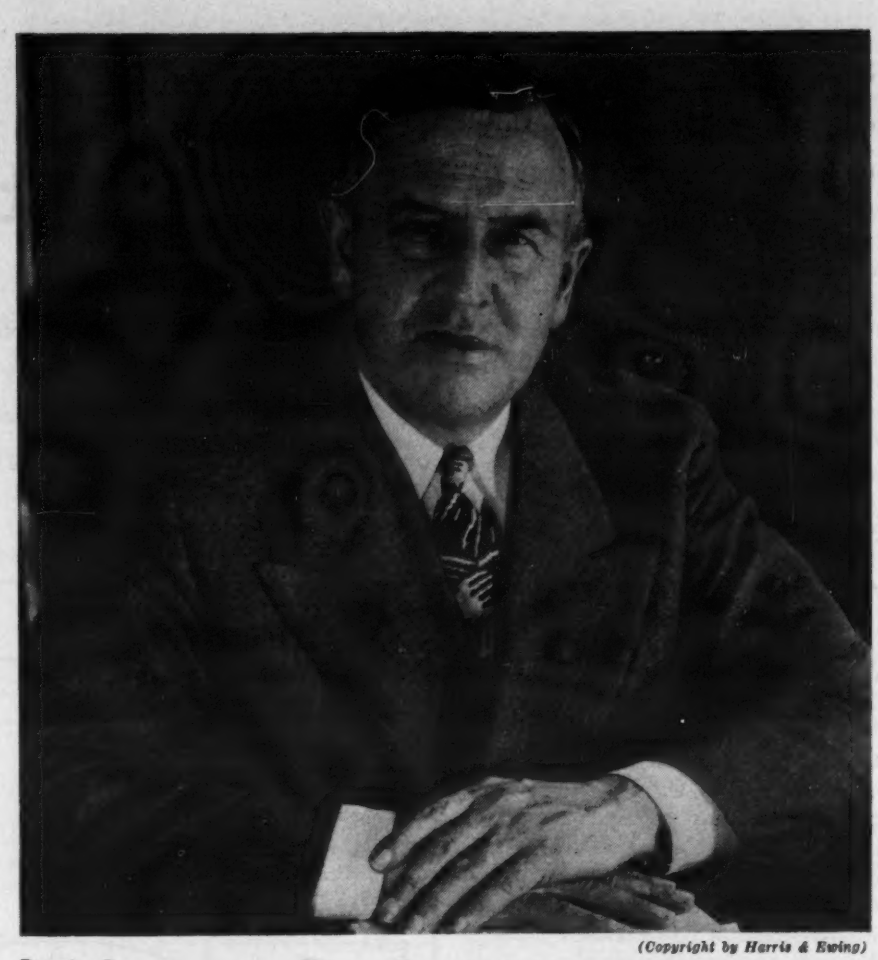
Of the technicalities of running an electric utility business, Mr. Brown claims no knowledge whatever. And apparently he does not feel he will need an intimate comprehension of those technicalities since he has a completely competent engineering and operating organization headed by the new president of the company, J. W. Parker. But one does not talk to him very long before acquiring the conviction that a sufficiency of such knowledge, covering the problems of engineering, sales methods, accounting and all the rest, will be his in a short time. This, supplementing his already demonstrated capacity in law and finance, plus his natural-born skill in the art of "making friends and influencing people," should make him the kind of utility head needed by the industry today and tomorrow.

And there is part of the answer to what Prentiss Brown will do in the utility business. He will do all he can to improve the industry in public regard—and he should be able to do

much in that important direction.

Was it politics that put Mr. Brown at the head of Detroit Edison? The answer is "yes," without any equivocation.

Prentiss Brown did not seek the chairmanship of Detroit Edison. The office was looking for a man and he was found. There can be no doubt but that Alex Dow stayed over long at the head of the company. This is said in simple recognition of the facts of life; men do grow old and die. By the time that Mr. Dow passed from the scene, exercising authority up to his last day, A. C. Marshall, who for years had been in training for the succession, was himself thinking of retirement. Thus Mr. Dow's exit left a vacancy that would be only temporarily filled and for which a permanent occupant should be sought.



(Copyright by Harris & Ewing)

Prentiss Brown

### *His Record in Congress*

Mr. Brown filled the bill. His success as a lawyer and a business man was a *sine qua non*. The more that was required came from his record in politics. In the Congress he showed himself a conscientious, intelligent, forward-looking, capable legislator, neither a doctrinaire nor a coat-tail rider, neither woolly-minded nor venal.

As a member of the Banking and Currency Committee in the House, he was a factor in the establishment of the Home Owners' Loan Corporation, of Federal Deposit Insurance, of the Federal Housing Administration and of the Rural Electrification Administration (not what it has become, but what it was intended to be). As chairman of the Special Senate Committee on Taxation of Governmental Securities and Salaries, Mr. Brown sponsored legislation that brought about reciprocal taxation of salaries of federal and state employees. He sponsored the act to tax income from federal government securities and sought, but unsuccessfully, to extend taxation to interest on bonds of state and local governments. Large credit for defeat of the administration proposal to pack the Supreme Court goes to Mr. Brown. These and other points in the record of his performance as a legislator are such as to inspire confidence in him in the minds of business men.

Detroit Edison, like every other utility, in fact in common with every other business undertaking, even the smallest, in the country, is in politics. The condition is unavoidable. Politics is the art of government. It is equally the concern of the governed and the governing. Abstention from participation in politics is bad; only one thing is worse and that is participation in devious and shady ways while proclaiming no interest. It must be confessed that the past record of the electric utilities in this respect is not without blemish. There is now a widening recognition of the fact that politics is a legitimate concern of business and the selection of Prentiss Brown to head Detroit Edison is an evidence of the trend.

And that is nothing new for Detroit Edison. Although he never ran for elective office, Alex Dow was a master politician. He served often and well in appointive positions for which he could spare time from his main job. He was a civic leader in many lines where he felt he could serve the community. His political actions and attitudes were open and above-board; his record is clear of the conniving kind. He established Detroit Edison in popular esteem and held it in that position for over a quarter of a century. If that is not the work of a politician in the honest meaning of the word, then no better example can be found. Thus Detroit Edison sought one politician to succeed another.

This is not to say that, except in candor and openness, Prentiss Brown can be expected to follow exactly the ways of Alex Dow in relations with employees, with the public and with government which are in the true sense, politics. Just as many different religions offer many roads to Heaven, so do the different ways of men point to the common goal of success. And after talking with him, one has the feeling that under Brown Detroit Edison will continue pretty much as it would have under Dow.

These, then, are the impressions gained by a visit with Prentiss Brown. Detroit Edison has a new chairman who is easy to meet and to talk to, who is wise not to sound off prematurely, who is fully conscious that the electric utilities must work hard to gain and enjoy public regard and who is a politician in the best sense of the word.

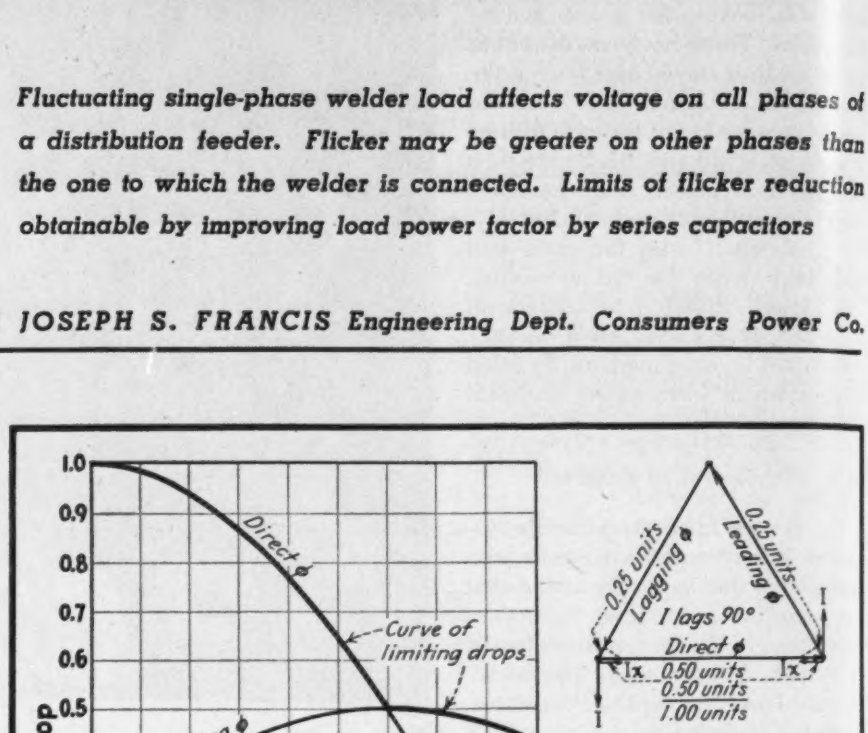
# Flicker From 1-Phase Welder Load Predictable

***Fluctuating single-phase welder load affects voltage on all phases of a distribution feeder. Flicker may be greater on other phases than the one to which the welder is connected. Limits of flicker reduction obtainable by improving load power factor by series capacitors***

***STEPHEN FREEMAN, Jr. and JOSEPH S. FRANCIS Engineering Dept. Consumers Power Co.***

MOST EFFECTIVE method of reducing the demand of welders, particularly resistance welders, without at the same time reducing the welder capacity, is to correct the welder power factor to or near unity by means of series capacitors. The series capacitors reduces kva. and current demand on the power system. Also the improvement of power factor *usually, but not always,* reduces the voltage drop per load ampere. Here, it is most important to observe that the drop over one phase of a three phase system affects the other phases also, since two conductors are necessary for a single phase load and at least one of these conductors is also involved in carrying load on another phase. For this reason, care must be used in determining the maximum flicker voltage, for in certain cases flicker voltage may become less on the welder (direct) phase than on one of the other two phases.

The second over-all benefit, reduction in flicker voltage drop per ampere by improving power factor, has perhaps not always been thoroughly investigated and the effect on other than the welder (direct) phase of a three phase system has often been overlooked. It is particularly this consideration that will be discussed.




**SIMPLIFIED vector diagrams for various values of load power factor yield curves of projected Z drop on three phases of a sample system for which ratio X/R is assumed infinite (resistance neglected).**

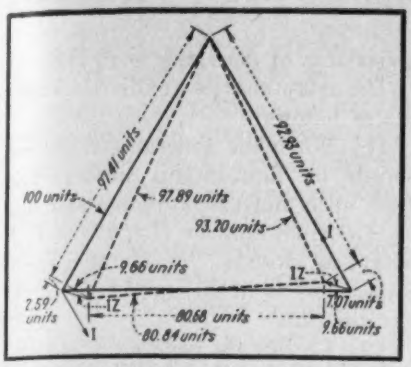
### *Range of Transfered Drops*

Briefly, the effect of single-phase welder load on phase voltages of three-phase power supply may be summarized as follows:

1. For X/R ratios less than one, the flicker voltage drop per ampere on the direct phase will be greater at high power factor than at low power factor.

2. For X/R ratios greater than 0.577, and less than 1.732, the greatest flicker voltage drop per ampere will always occur on the direct phase, that is, the phase to which the single-phase flicker load is connected.

3. For X/R ratios less than 0.577 and greater than 1.732, the flicker voltage drop per ampere may be greater on other phases than the direct phase. This effect will occur at high

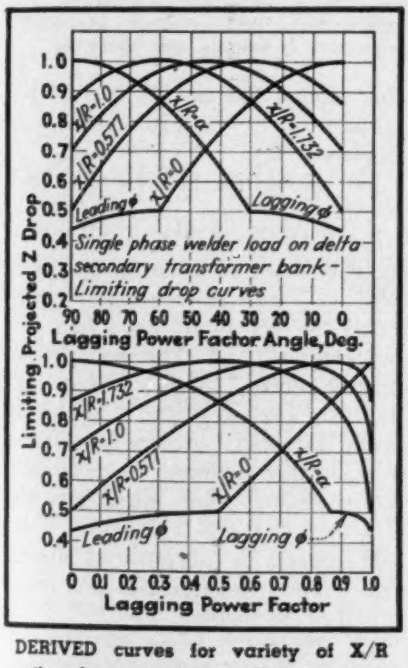



**VECTOR analysis shows effect of single phase welder load on three phase system. Approximate solution for effect of single-phase welder load gives reasonable accuracy: errors are 0.49 percent on lagging phase, 0.29 on leading phase and 0.20 on the loaded phase**

power factors for X/R ratios greater than 1.732 and at low power factors for X/R ratios less than 0.577.

4. The effects mentioned in (3) limit the reduction in flicker voltage drop per ampere which may be obtained by improving the load power factor to a maximum ratio of 1/0.433.

In any application of series capacitors to correct power factor, reduction in demand on the power supply system, and power factor improvement take place simultaneously. To analyze the problem with reference to power factor correction alone, for the sake of simplicity, a circuit is assumed in which the line amperes remain constant while power factor changes from a low lagging value to unity. This is the basis for the accompanying diagram and curves.




**DERIVED curves for variety of X/R ratios shows variation in flicker voltage with power factor and indicates at what critical values of X/R voltage drop on other than welder phase should be calculated**

Considering first the phase to which the welder is connected and assuming that the power supply system has a high ratio of reactance to resistance, say 5 to 1, then, as the same ampere demand is maintained upon the system but the power factor of the loaded phase is corrected, the voltage drop at the welder decreases from an amount equal approximately to the IX drop, to a value which represents the IR drop only, and this reduction may be as much as 5 to 1. However, while this is happening, the IX drop in one of the phase wires carrying the welder load swings into line with one of the idle phase voltages, so that it adds or subtracts directly from the line voltage of this idle phase. Under certain circumstances commonly appearing on circuits supplying single phase welder load, (usually high power factor loads on high reactance circuits), maximum flicker may occur on the idle lagging phase.

### *Vectors Show Effects*

Accompanying vector diagram shows graphically the effect of a single phase load on each of the three phases of a three-phase system for one value of load power factor and one ratio of power system X/R. Exact and approximate solutions are compared, and for a practical system maximum drop of 20 percent, the error in using the approximate solution is less than ½ of 1 percent, which is clearly within the engineering accuracy to which other factors in the problem may be obtained. For ease of calculation, the approximate solution will be used for the following discussion.

Also shown are simplified vector diagrams for three different power factor loads applied to a system whose impedance is assumed to be all X (resistance neglected). If maximum voltage drop on the direct phase is taken as unity, then values may be found for different power factors or power factor angles. Plotting these values of drop against power factor angle produces the curves accompanying the vector diagrams, showing that a critical point occurs at a power factor angle of 30 deg. where the voltage drop on the lagging phase equals the voltage drop on the direct phase.

Curves for a variety of X/R ratios may be calculated. A set of these curves for critical values of power system X/R, plotted for both power factor angle variation and power factor variation accompanies this article. These curves help to tell quickly whether or not calculation of voltage drop on other phases than the welder phase should be made and also serve as guides to check calculated values.

While the above diagrams are made on the basis of an underground delta system, the conclusions reached will be found to hold regardless of the arrangement of the three-phase power supply, whether it be wye, delta, grounded or ungrounded. The same method of procedure and like diagrams may be constructed for a large number of special cases, but it will be found that these represent only slight variations from the case described in this article.

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## The Magpies' Nests

"File it," says the American executive, and that, more often than not is the last that is ever heard of the matter. For decades it has been the custom in our well known efficiency system to file just about everything—unimportant letters, memoranda about nothing, reports on this and that, and pamphlets and clippings world without end. We were headed for a time, mathematically demonstrable, when every large city would consist of nothing but filing cabinets. These moody reflections are brought about by the news that the officials of the New York Central Railroad went through their so-called dead files (that's an art it itself, determining when a file is really "dead") and threw out 139 tons of paper, which went to the waste-paper salvage drive. For the most part this material consisted of outdated correspondence and will never be missed. The discovery of the New York Central that it could spare such an astonishing amount of old paper ought to suggest to other business organizations that perhaps, after all, a lot of those old files, built up over the years with such systematic care, are really just so much junk. Now is an excellent time to clean out these magpie's nests of business. The paper is needed urgently.—(*The New York Herald Tribune*).

# Turbine-Generator Field Current Relay

***Minimum and maximum safe values of field current are signalled during starting and operating periods of cross-compound turbine-generator sets —Also applicable to other alternators***

***P. H. ADAMS*, Public Service Electric and Gas Co.***

A DIRECT-CURRENT relay connected in the field circuit of 3,600-rpm. cross-compound turbine-generators gives notice of unsafe field current value during the starting as well as the operating period. The relay is also used on other large turbine-generators to sound warning of low field current during the operating period.

Cross-compound turbine-generator sets, when they are available for service but are not actually in use, are usually kept turning at 3 or 4 rpm. by an electric motor equipped with a throwout gear. When an order to put a unit in service is received in the control room, orders are issued to the boiler room and the turbine room to prepare for starting the unit. Boilers are made ready, pumps are started, and the switches that connect the generators of the high- and low-pressure elements in parallel are closed.

### *Starting Procedure*

From a motor-driven exciter there is then applied to each generator the minimum field current that is required to hold them in synchronism during the starting period. The signal to start is then given to the turbine room, where steam is now available and the necessary pumps have been started. Steam is admitted to the high-pressure element whereupon it picks up speed pulling the low-pressure element with it as a synchronous motor. The unit requires considerable time to attain full speed. During this period the instruments in the control room are watched so that any electrical trouble that may develop is detected at once.

When full speed is attained the control room is notified and if there are shaft-driven exciters on the generators, these are placed in service and the motor-driven exciter is shut down. The field strength of the generators is then increased to synchronizing value and the unit is synchronized with the system. The signal is given to the turbine room to open the throttle and the desired load setting is made.

### *Overheating Avoided*

During the starting period the ventilating and cooling system of the generators is not functioning and it is important to keep the field current at a minimum to avoid overheating the rings and rotor windings. The field current, however, must be sufficient to hold the generators in synchronism during the starting period or the high-pressure element will speed up and leave the low-pressure element at turning gear speed, resulting in excessive stator current.

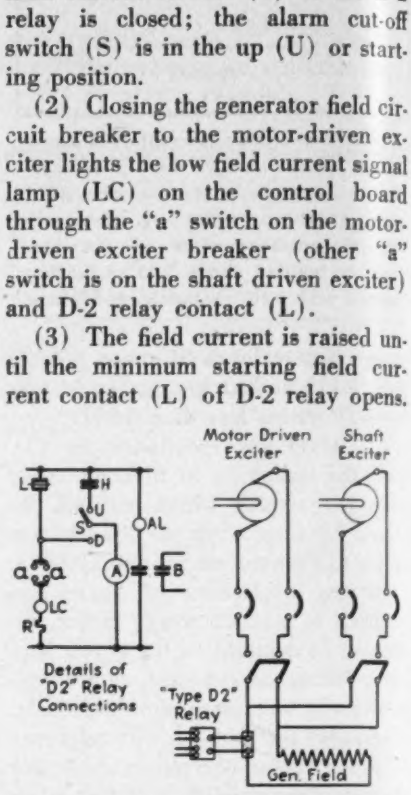
The Westinghouse type D-2 relay with permanent magnets connected as shown in the accompanying diagram is being used by Public Service Electric & Gas Co., to assure proper field current values. The relay settings used for 62,500-kw. generators requiring 730 amp. field current at rated load are 220 amp. minimum and 350 amp. maximum field current for the starting period where the units are elements of a cross-compound set. Similar settings are being used on other generators of the single shaft type.

The relay and its auxiliaries operate as follows:

(1) When the generator is out of service the field circuit breakers are both open and the minimum starting field current contact (L) of the D-2 relay is closed; the alarm cut-off switch (S) is in the up (U) or starting position.

(2) Closing the generator field circuit breaker to the motor-driven exciter lights the low field current signal lamp (LC) on the control board through the "a" switch on the motor-driven exciter breaker (other "a" switch is on the shaft driven exciter) and D-2 relay contact (L).

(3) The field current is raised until the minimum starting field current contact (L) of D-2 relay opens.




**CONNECTIONS of relay to give notice of unsafe field current values on turbine-generators in starting and operating**

This extinguishes the low current signal light (LC) which is in series with resistance (R).

(4) Should the field current reach or exceed the maximum starting field value that contact (H) of the D-2 relay will close, pick up the auxiliary relay (A) and close contacts which sound the alarm (B) and light the annunciator (AL). The field current must be reduced to open contact (H) and drop auxiliary relay (A) to stop alarm. Safe field currents for starting is any value between the maximum and minimum points where contacts (H) and (L) are both open. When field current is adjusted to a safe value on both generators, steam is admitted to the turbine.

(5) The field current is kept at this value until the full speed signal is received; then the change from the motor-driven to the shaft exciter is made and the circuit in (2) above is now made through the "a" switch on

*Consulting Electrical Engineer, Electric Engineering Department

the shaft exciter circuit breaker.

(6) The field current is now raised to synchronizing value which is higher than the maximum starting field current. At the latter point the D-2 relay closes its maximum starting field current contact (H) and sounds the alarm (B), whereupon the alarm cut-off switch (S) is turned to the down (D) or running position.

(7) The unit is then synchronized and field strength and load are adjusted to the desired values. The maximum starting field current contact (H) of the D-2 relay stays closed while the minimum field current contact (L) is open during the operating period.

(8) The alarm cut off (S), now in the down or running position, has the alarm circuit set up to sound the alarm and light up the annunciator should the field circuit be broken or the field current drop to or below the value at which the minimum current contact of the D-2 relay closes.

(9) When shutting the unit down the alarm cut-off switch is thrown to the up or starting position when the field circuit breaker is opened or the field current is reduced below the minimum starting value.

### *Heavy Stator Currents*

Loss of field excitation from a turbine-generator causes the unit to increase its speed to the point where, operating as an induction generator, it regains its load. Under this condition, its excitation is drawn from the system in the form of mvar and the resultant stator current may be three to four times rated full load current if the nearby capacity of the system is sufficient to maintain full voltage.

The heavy leading current in the stator causes a counter current to flow in the surface of the rotor which in 30 to 60 seconds may cause considerable rotor damage, particularly if the kilowatt load on the unit is above 60 percent of its rating, unless the condition is remedied promptly.

The foregoing description is confined to the operation of the relay with cross-compound generators; however, when used with any type of alternating-current synchronous generator it will give warning of loss of field excitation in time for remedial measures to be taken before the rotor is damaged. Thus a field under-current relay may be useful in protecting any turbine-generator.

# One Ampere Current Transformer Proposed

***A standard line of current transformers with one ampere secondaries is proposed on the basis of large copper saving and to reduce secondary burdens — Examples of usage cited***

***LLOYD F. HUNT and J. H. VIVIAN*, Southern California Edison Co.***

USE of one ampere secondaries on current transformers and their circuits will save a considerable amount of copper in secondary leads, thus aiding the war effort materially in curtailing uses of copper and at the same time would have the very important advantage of greatly reducing the burden imposed by long secondary leads. One ampere current transformers, instruments, relays and meters are no more difficult to build than the present standard 5-ampere type.

There seems to be no difficulty in the design of 1-ampere equipment. Actually, small coils of instruments and relays could more easily be made once tools were set up for their manufacture. The great saving in copper that would result in the design of large power plants and switching stations is significant, although savings can be shown in most all installations of current transformers. It seems that enough gain can be made by using a 1-ampere secondary for current transformers to justify having a 1-ampere standard established.

Since the secondary burden is equal to $I^2R$, it can readily be seen that the volt-ampere burden of the same leads with 1-ampere secondaries is 1/25th that of 5-ampere secondaries. Assume the leads of a 1,000-foot loop using No. 6 copper cable. Resistance is 0.4 ohm, so that with 5-ampere secondaries the burden is 10 volt-amperes. With 1-ampere secondaries the burden would be only 0.4 volt-amperes.

A lead of equivalent burden with 1 amp. secondary would have a resistance of 10 ohms per 1,000 foot. This would be a No. 22 copper wire. Since No. 6 weighs 79.5 pounds per M and No. 22, 3 pounds per M, a saving of 76.5 pounds of copper would result. This means that with a set of three current transformers where four leads are used there would be a saving of 153 pounds of copper if the leads were 500 feet in length.

In practice, No. 22 wire may be considered too small from a mechanical standpoint, therefore, the smallest size that would do mechanically should be considered. If No. 14 copper wire be considered as the smallest size practicable mechanically, then the 1,000-foot loop, having a resistance of 2.5 ohms, would give a burden of 2.5 volt-amperes as against the 10 volt-amperes with the 5-ampere secondary and No. 6 wire, or the 1-ampere secondary and No. 22 wire. In the 500 foot run the weight of copper would be 25 pounds with 1-ampere secondary and No. 14 wire as compared with 159 pounds with 5-ampere secondary and No. 6 wire, or a saving of 134 pounds of copper per set of current transformer leads.

The Southern California Edison Co. has used 1-ampere secondary current transformers in several places for two reasons, i. e., the saving in copper and to lessen the burden imposed by the leads. At the Boulder power plant it was necessary to have long current transformer leads for the main transformer differential relays because the current transformers on the 230-kv. side were in the oil circuit breakers in the

* Senior Electrical Engineer and Protection Engineer, respectively

switch garden located some 3,800 feet from the relay board.

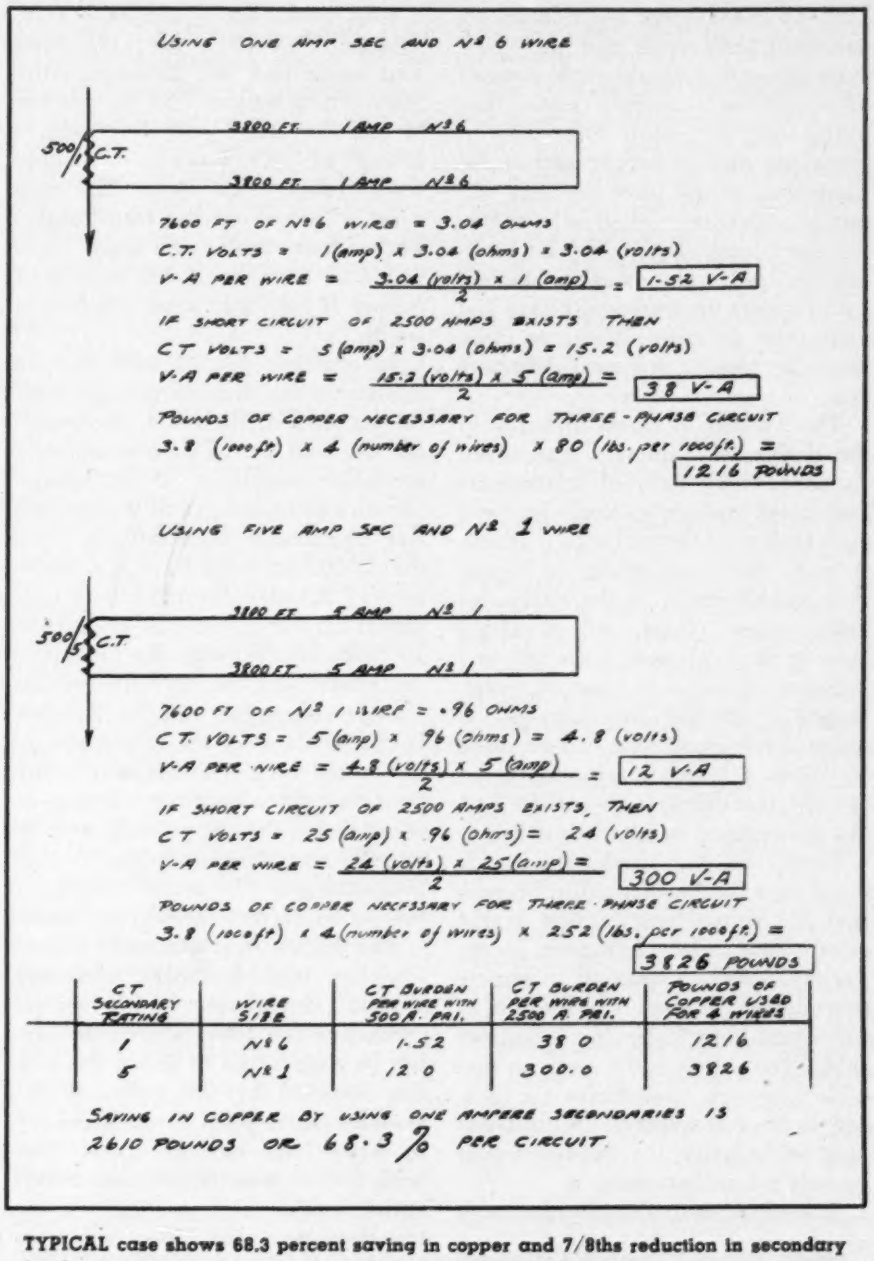
Since use of 5-ampere secondaries dictated need for a very large cable it was decided that better results would be accomplished by using 1-ampere secondaries instead. These leads consist of four No. 6 copper cables 3,800 feet long which makes a volt-ampere burden of 3.04 for the 7,600 foot loop, and total weight of copper of 1,216 pounds.

Previous to this installation, 5-ampere secondary leads were used on similar long runs consisting of four No. 1 copper cables with weight of copper 3,826 pounds. As against this the 1-ampere leads show a saving of 2,610 pounds of copper. Moreover, the volt-ampere burden of the 1-ampere leads is 1.52, while the 5-ampere leads have a 12 volt-ampere burden. Thus, there was a large saving in copper as well as a distinct improvement in characteristics.

These 1-ampere current transformers and relays have been in operation for many years with no difficulty attributed to the 1-ampere secondaries. In fact, if all the current transformers at Boulder had been designed and used with 1-ampere secondaries, many tons of copper would have been saved and it would not have been necessary to use the 5 to 0.1-ampere auxiliary current transformers for the switchboard instruments. This simplification also would have saved a considerable expense.

In a Southern California industrial plant a series of 11-kv. loops were used to feed various buildings. The only type of protection that seemed feasible was the use of pilot wire protection. Calculations showed that if 5-ampere secondaries were used a very complicated set-up of using step-down current transformers would be be necessary to cut down the burden of the leads. This complication was obviated by using 1-ampere secondaries with 1-ampere relays. This 1-ampere installation has a perfect operating record over a period of several years.

In another case, in order to supply a very important load at 11-kv. it was necessary to build duplicate substations using an elaborate system for the isolation of the relay circuits. The load was supplied from each substation over two 11-kv. circuits. All current transformers had 1-ampere secondaries. In this case, 1-ampere secondaries were used to assist the war effort by saving copper, conduit and other critical materials. The actual saving in copper in this installation amounted to 3,816 pounds. At the same time the secondary burden was reduced by 75 percent of what it would have been with 5-ampere leads.


USING ONE AMP SEC AND Nº 6 WIRE
500/1 C.T.
3800 FT 1 AMP Nº 6
3800 FT 1 AMP Nº 6
7600 FT OF Nº 6 WIRE = 3.04 OHMS
C.T. VOLTS = 1 (amp) x 3.04 (ohms) = 3.04 (volts)
V-A PER WIRE = 3.04 (volts) x 1 (amp) / 2 = 1.52 V-A
IF SHORT CIRCUIT OF 2500 AMPS EXISTS THEN
C T VOLTS = 5 (amp) x 3.04 (ohms) = 15.2 (volts)
V-A PER WIRE = 15.2 (volts) x 5 (amp) / 2 = 38 V-A
POUNDS OF COPPER NECESSARY FOR THREE-PHASE CIRCUIT
3.8 (1000 ft) x 4 (number of wires) x 80 (lbs. per 1000 ft.) = 1216 POUNDS
USING FIVE AMP SEC AND Nº 1 WIRE
500/5 C.T
3800 FT 5 AMP Nº 1
3800 FT 5 AMP Nº 1
7600 FT OF Nº 1 WIRE = .96 OHMS
C T VOLTS = 5 (amp) x .96 (ohms) = 4.8 (volts)
V-A PER WIRE = 4.8 (volts) x 5 (amp) / 2 = 12 V-A
IF SHORT CIRCUIT OF 2500 AMPS EXISTS, THEN
C T VOLTS = 25 (amp) x .96 (ohms) = 24 (volts)
V-A PER WIRE = 24 (volts) x 25 (amp) / 2 = 300 V-A
POUNDS OF COPPER NECESSARY FOR THREE-PHASE CIRCUIT
3.8 (1000 ft) x 4 (number of wires) x 252 (lbs. per 1000 ft.) = 3826 POUNDS

| CT SECONDARY RATING | WIRE SIZE | CT BURDEN PER WIRE WITH 500 A. PRI. | CT BURDEN PER WIRE WITH 2500 A. PRI. | POUNDS OF COPPER USED FOR 4 WIRES |
|---|---|---|---|---|
| 1 | Nº 6 | 1.52 | 38 0 | 1216 |
| 5 | Nº 1 | 12 0 | 300.0 | 3826 |

SAVING IN COPPER BY USING ONE AMPERE SECONDARIES IS 2610 POUNDS OR 68.3 % PER CIRCUIT.

**TYPICAL case shows 68.3 percent saving in copper and 7/8ths reduction in secondary burden by using one ampere secondary current transformers**

### *Design Problems*

Investigation of current transformer designs has shown no real problems, excepting perhaps, in the exceedingly high ratios. One ampere current coils in instruments would be wound with five times the number of turns of wire of 1/5th the size that is used in the 5 amp. coils. In most cases, after proper set-up has been established, the 1-ampere coils could be wound with less difficulty.

Coils using enamel wire would have the same winding space, but the space used for looping the taps would be considerably less on the 1-ampere coil, thus making a better coil.

From all the studies made and from experience gained, there is no apparent difficulty in the design or use of 1-ampere secondary current transformers, 1-ampere relays, 1-ampere instruments, or 1-ampere meters. It is therefore proposed that a standard line of 1-ampere devices be established.

# TOMORROW'S DISTRIBUTION AND TRANSMISSION

By A. E. KNOWLTON, *Associate Editor, "ELECTRICAL WORLD"*

A SURVEY of the utility industry reveals that the majority of the units expect increases or shifts in loads in the post-war era that will necessitate substantial expansion or reinforcement of their urban and suburban distribution systems. The load increases over five years will more than absorb the average residual capacity in existing systems. Considerable activity in new housing is expected to further increase the requirements.

Service continuity and quality are as likely to be raised as merely held at pre-war levels; there is little or no feeling that they can be lowered. Costs of overhead lines can not much more than be held level in the face of rising costs although various measures can effect relative economies.

Tree trimming and intensified inspection are viewed as more effective in promoting service reliability than any other factors such as sectionalization, quick fault clearing and automatic restoration of service.

The induction regulator continues to hold first place as a means of sustaining voltage with the capacitor which was much lower in the scale in the pre-war efforts taking second place as an aid to voltage delivery. Addition of substations will come next in order of importance in making distribution adequate. Interest in primary networks is limited.

Appreciable amounts of underground construction are indicated; it will follow very largely the construction practices of the past. Nevertheless a portion will be aimed at modification in the form of having either the transformers or conductors above ground with the remainder of the circuit in ducts or vaults. Resort to buried cable will be limited. Preference appears to hold to lead for-sheathing although there is open-mindedness toward non-

metallic coverings for the buried cable contemplated.

These trends are derived from an analysis of 93 reports from private utilities and 39 municipal systems. The number of meters of the private utilities totals 17,822,673 and of the municipals 1,286,323. The grand total is thus over 19 million meters and constitutes, therefore, a better than 60 percent sampling of the country. All but four states are represented. Utilities are classed as large if of over 100,000 meters and small if under 20,000. Municipals are classed as small if having under 5,000 meters.

In the transmission field there are numerous indications of lines needed over new routes and a very limited amount of raising of voltages. Interest in a higher voltage than 287 kv. is limited to a single system and in d.c. transmission is similarly restricted. Faster relaying is desired above all else as a means of enhancing the reliability of existing lines. Wood will hold the favor for structures except where heavy electrical or mechanical loading is involved.

For the trends in transmission reports were received from 59 utilities and municipals presenting 13,788,539 meters or a 40 percent sampling of the country but a much larger fraction of the utility systems having transmission lines.

A subsequent issue will present a similar report on the trends in the field of rural lines.

# DISTRIBUTION

# LOAD TREND

## Load Forecast

Three out of every five electric systems are forecasting an early post-war load that will increase or shift so as to necessitate substantial expansion or reinforcement of their distribution systems. The municipals utilities are just a bit more confident about the prospects than the private utilities, both large and small (under 5,000 meters) municipals expecting, 2 to 1, that there will be substantial growth. The large utilities (over 100,000 meters) also stand 2 to 1 on the "yes" and "no" of growth or shift in load. There are more of the small (under 20,000 meters) and medium utilities that expect that expansion or reinforcement of distribution will not be indicated for the postwar period than there are those who have been advised by their commercial departments to expect sizeable activity.

**Forecast Expansion or Reinforcement of Distribution**

| | Yes | No |
|---|---|---|
| Large utilities | 26 | 13 |
| Medium utilities | 23 | 21 |
| Small utilities | 4 | 1 |
| Large municipals | 15 | 8 |
| Small municipals | 10 | 5 |
| Totals | 78 | 48 |

## Load Growth

Over the five postwar years the majority of utilities and municipal systems are figuring on load increases of from 10 to 50 percent. This is true of large, medium and small units; however, a somewhat larger percentage of the municipals expect 25 to 50 percent than is the case with the private utilities, the latter leaning toward more moderate increases. A few of both groups are looking for as much as 100 percent expansion in the 5-year period. On the contrary, about 10 percent of the aggregate of both groups expect no increase at all.

**Expected Percentage Load Increase in 5 Years**

| | None | 1 to 24 | 25 to 49 | 50 to 99 | 100–200 | Over 200 |
|---|---|---|---|---|---|---|
| Large utilities | 4 | 17 | 11 | 3 | 1 | 0 |
| Medium utilities | 4 | 25 | 12 | 6 | 0 | 0 |
| Small utilities | 0 | 5 | 4 | 1 | 0 | 0 |
| Large municipals | 3 | 7 | 9 | 2 | 1 | 0 |
| Small municipals | 2 | 3 | 4 | 5 | 1 | 0 |
| | 13 | 57 | 40 | 17 | 3 | 0 |

A lull of from 6 to 24 months is mentioned in several instances and the growth in others is stated with respect to the pre-war level rather than with respect to the war value. Residential and commercial loads are asserted to be much more promising than the industrial. The decline in two- and three-shift operation with prospective increase in non-industrial loads is sensed as having an adverse effect on peaks and load factors. In a few instances the growth is looked for only in the rural areas served.

## Community Trends

As to the residential and commercial loads shifting to suburban living and shopping centers there is divided opinion. A few more of the utilities and municipals feel that there will not be such a shift than those who do. The private utilities as a group are almost evenly divided on the issue. The large utilities, however, in almost three to one ratio feel there will be such shift but those indications are frequently flavored with such qualifying remarks as "some," "moderate," "small extent," "possibly," "slight," or "yes, but not to those we serve." Medium-sized utilities (20,000 to 100,000 meters) in a five to three reverse ratio feel there will be no shift. The small units are almost unanimous that they will experience no defection.

Large municipals stand two to one in believing there will be no suburban shift. Many do not, of course, serve suburban areas. The small municipals (under 5,000 meters) are about evenly divided on the question.

## Replacement of Lost War Loads

Consensus on the compensation for lost war loads by loads elsewhere on the system is preponderantly that that will happen but that it will take time, usually expressed as 2 to 5 years. In no classification of utility or municipal size is the overall expectation the opposite.

However, many of the affirmative indications are qualified by comment to the effect that it will be a partial compensation only; just a few say that it will happen to any large extent. Evidently much depends on the wartime load of the system and how much was dedicated to war production. Several replies carried the reminder that load factors are expected to be poorer and others that load factors are already showing signs of dropping. Abandonment of third and even second shift operation is a large influencing factor. If the European war can be terminated before the Pacific campaigns it will, it is commented, materially assist in conversion to civilian production and alleviate the transition. One or two expect that pent-up civilian buying may spend itself in about 3 years and lead to a subsequent lull.

## Industrial Influx

Few utilities and even a smaller fraction of municipals look for any significant influx of industrial plants to smaller communities. None whatever of the small utilities and only a lone municipal expect the commonly-mentioned trend of industrial migration to affect them favorably. The over-all proportions are four to one against the prospect.

Even where the answer was "yes" there was comment along the lines of "normal growth," "limited," "some industrial interest" or that the communities are active in diversifying and solidifying their industrial activities. Occasional comment is made that there is considerable present concentration or that there is a shortage of plants and sites; new industries will take up vacancies in existing industrial sections in some instances.

## Housing Projects

New housing developments in areas not at present served with electric distribution are expected by practically half the utility systems. The utilities are somewhat less assured (3 to 4 ratio) than the municipals (2 to 1) about the prospect.

The large utilities are more hopeful (6 to 5) than the medium-sized utilities (1 to 2), probably because they present most positively the very congestions which prompt the trek to the suburbs.

In hardly any instance is there expectation of home building in boom proportions, the more common feeling being that the expansion will be appreciable but limited in pace and scope.

In one instance it is vouchsafed that wartime homes will be removed; in several cases it is indicated that the apparently snug systems have no unserved areas.

## Flicker-causing Loads

Another moot question is whether there will be a significant increase in welder, furnace, or other flicker-causing load. Taking all systems there are merely a few more who expect such new loads in sizeable volumes than there are those who do not. However, it is the large utilities who afford most of the prediction. The medium and small utilities are about evenly divided on the issue. Municipal systems are almost 2 to 1 of the opinion that they will not have to contend with much increase in such troublesome load.

There is a "hope not" flavor detectable through the entries and the emphasis seems to be on the welder; however, there is the feeling that the customer has to be served and the brunt borne somehow. Welders fed from motor-generator sets are naturally viewed with less concern. That the welder loads will arise in rural districts is also indicated. High frequency heating was mentioned as a prospective load but there was no indication that flicker trouble should be expected.

## System Load Capability

Just about half the electric distribution systems can take 15 to 25 percent increases in loading as they now stand. One in eight can take more, very

few up to 75 percent and one municipal up to 100 percent. But nearly a tenth are now loaded to capacity and could add little or no load. This is a more prevalent situation with the municipals than with the private utilities. About one in five could not handle more than 10 percent additional loading.

The most common estimates for added outlay were at 25 and 50 percent. Few of the utilities mentioned less than 20 percent or more than 50 percent increment. Quite a few of the medium-sized utilities reported from 60 to 90 percent and only one as low as 10 percent. A few more municipals than utilities believe the doubled loading could be achieved with 20 percent or less added investment; possibly this is because their systems are usually more compact. Three, however, thought the increment would be 100 or even as high as 125 percent.

Reverting to the answers to the query on expected increases in loading, it is apparent that a considerable fraction of the systems will have to be reinforced. Even then all but one-eighth will have little or no margin left, a situation contrary to the usual practice of providing a 15 to 25 percent margin for staggered growth.

### Outlay for Doubled Capability

Two-thirds the utilities and municipals together consider that a 20 to 50 percent additional distribution outlay would be necessitated by a doubling of usage. As might be expected, the estimated values are fewer in number than for other items because the reply perforce has to be a generally good surmise. Much is reported to depend on the character of the added and resultant consumptions. One report denied that there was any relation between added outlay and added kw.-hrs.

# SERVICE STANDARDS

### Continuity of Service

Practically half the electric entities of the country are convinced that, despite the good service continuity achieved before and even during the war, it will have to be still better in the postwar period. The other half of both private utilities and municipals believe it will at least have to be as good as before. Out of 136 units there was only one that avoided the question, only one that felt that standards could be relaxed.

The consensus is that homes, farms, business and industry will all be increasingly dependent on electric service and increasingly conscious therefore of the frequency and duration of interruptions. The systems feel generally that they had established pretty good service before the war and some claim that no war plant and very few homes have suffered outages since hostilities started. Nevertheless "the industry cannot be static," nor is there any indication that users will be content with lowering of standards. Where service was better than good it appears that it will have to be emulated, where merely good it will have to be outdone. Apparently the city performance is in the former class but there runs through the reports the feeling that suburbanites and ruralites will deserve even bettered quality in terms of continuity.

Among the physical factors mentioned as having a bearing on sales efforts that carry promises about service reliability are farmstead and home deep-freeze units, community lockers, frequency modulation radio, television, ranges, oil burners and stokers, clocks, dairy and poultry equipment, industrial air-conditioning. During the period while bulging-pocketed customers are still scrambling to satisfy these wants they may not be critical about service but when the wave of buying is over, it is said that they will be expecting fewer interruptions and quicker restorations.

Fortunate from the system outlay standpoint in the face of this recognition of "nickel-plated" service is the reminder from one source that the war has taught utilities how to support service continuity with fewer spares and narrower margins of carrying capacity.

### Voltage Regulation

Well over half the systems believe there can be no relaxation of voltage regulation in the postwar period. A third of them are convinced that the regulation band must be narrowed and less than 10 percent feel that advantage can be taken of a widened band in system design and operation. The proportions hold alike for utilities and municipals except that a few more of the large utilities feel that the performance can be relaxed somewhat. One mentions the WPB sanctions as having started a liberalization which is tolerable and not productive of undue complaints. Improvement is sensed as more pertinent to rural and suburban areas than to the cities. In normal times commission rules govern and there is no indication that any revision and

liberalization can be expected; they are called in some quarters an expression of the requirements for good service.

At no point was there mention of a possible program of appliances manufactured to meet a broadened spread of utilization voltage. In fact, the sentiment seems definitely to be that the appliances, present and future, and their owners will both look for closer-held voltages. Attention was called to the fact that a narrowed band will both necessitate and be stimulated by the availability of improved regulating and control equipment. Flicker from the starting currents of domestic-appliance motors is cited as a bugbear. Electronic devices appearing anywhere on the system are mentioned as dictating bettered voltage everywhere.

From just one source comes the intimation that 120 volts is going to be too low for ultimate requirements and that even 440-volt ranges would be welcomed at a not-too distant future.

The conclusion that more and/or better voltage regulating equipment is indicated was an item mentioned specifically in some of the reports received in response to the queries.

# STANDARDS OF PRACTICE

## Distribution Cost Reduction

Various measures have been and apparently can still be useful in holding down the construction cost of overhead lines in residential areas. Some of the items favored in the reports, listed in the order of prominence, are: (1) Standardization of the materials of construction, (2) simplification of design, (3) resort to unit assemblies, (4) streamlined pole arrangement, (5) self-supporting cable. These were mentioned as helpful factors even by half the companies and municipals which expressed the belief that the cost of overhead lines cannot be materially reduced. Numerous comments were to the effect that any physical savings through more economical design and erection would probably be cancelled by the higher labor and material costs that are feared will prevail.

Even the thirty percent of the units which have the feeling that the line costs can be reduced were often found saying "somewhat," "partially" or "slightly" as a substitute for the "materially" contained in the query. The municipal systems were found substantially more sanguine (two out of five) about the prospects than the private utilities (one out of four); possibly this is because they have not all taken advantage of the measures applied by many of the utilities.

Among the utilities alone, the unit assemblies took parallel position with simplified overhead line design as a measure which can help trim the cost of distribution in residential areas. Nevertheless there were several dissenting or skeptical comments about unit substations. These, along with some of the metal-clad switchgear, are considered by some too crowded for satisfactory maintenance and not flexible enough to minimize interruptions; that they may cost less for single bus layouts but often prove more costly than system designs for double-bus setups was another comment.

While "sold" on the unit substation for outlying areas up to 3,000 kva., one group would prefer a single large breaker and a minimum of small ones. Another considers them convenient from a handling standpoint but "the value in appreciably reducing distribution costs is doubtful." These comments are in definite contrast to one assertion that unit assemblies should be used in increased numbers in the postwar period and another that their economic value is great. Again, on the contrary, several respondents took pains to register a "no" against unit assemblies while leaving other queries unanswered.

## Measures Already Applied

Several of the replies indicate that most of the measures toward less expensive distribution have already been applied. Scattered comments suggested additional items that can be tried:

(1) More efficient application of manpower is the principal remaining possibility in reducing pole line costs

(2) Reduction in size of minimum standard pole

(3) Bare primary in limited urban locations

(4) Higher voltage

(5) Extension of common neutral system; reduction of number of wires to a minimum

(6) Ground-return messenger supporting secondary conductors; mid-span services

(7) Carrier-controlled multiple street lighting

That local ordinances and state regulations may impede efforts to reduce distribution costs is the mention of a municipal ruling against the use of secondary racks and another reminding that commission standards of construction are hard to get modified in the direction of simplification and economy.

Evidently there is little solace for anyone hopeful of substantial reductions in cost of pole lines. Any

reduction in the cost of distribution systems will apparently have to come from the basic plan embracing such factors as the scope of sub-transmission and trunk feeders, the spotting and design of the substations and the general effort to bring the high voltage circuits close to all consumers.

There is comment, too, that all costs are relative and that although the absolute unit-of-distance cost may not readily be reducible it can be diluted in proportion to revenue by judicious promotion of heavy-duty loading.

### Conductors

As might be expected, copper holds an outdistancing first place as the conductor material for urban and suburban areas. Approximately one-third the utilities and municipals mention aluminum and another third mention prospective use of copper-steel. The very limited mention of iron wire pertained almost entirely to rural use (which was outside the scope of the particular query).

Whether aluminum will be accorded application as a bare or weatherproof conductor to anything like the extent indicated by the one-in-three proportions tabulated is apparently quite dubious. Numerous comments were to the effect that relative price will be a large determining factor. Other comment is that use will be limited or conjectured. Drawbacks mentioned were the relative difficulty in making good joints and the greater proneness of aluminum to oxidize and pit. Several of the more inclined utilities stipulate that their possible use of aluminum conductors would be restricted to the suburban fringes or rural areas. One large utility hopes that it can be available in Neoprene jacket. One small utility plans to use aluminum more extensively.

As in the case of aluminum conductor, the copper-steel is often mentioned as restricted in prospective use—"minor," "limited," "very little" are common qualifying phrases; one small utility expects to use it much more extensively, however. A large-utility comment is that there is little justification for using a high-strength, high-cost conductor on the short spans that dominate in urban areas; suburban stretches are indicated as more conducive. A municipal system contemplates the possible use of copper-steel for street-lighting circuits.

# SERVICE RELIABILITY

Foremost among the factors which can contribute to service reliability of distribution systems in urban and suburban areas is the matter of tree trimming. A close second is intensification of inspection and maintenance.

These two are the leaders regardless of the method used in analyzing the replies to the question as to how much they and 9 other items are considered as contributing to reliability in a primary or secondary degree. Both head the list in entries in the "primarily" column; likewise they lead in the "secondarily" and when the "primarily" and "secondarily" are combined. Assuming that an item was considered of very minor or negligible importance if ignored in the report, these same two items top the list through being left blank the fewest number of times.

On this basis then the greatest contributions to distribution reliability stand in the following order of importance.

1. Tree Trimming
2. Intensified Inspection and Maintenance
3. Sectionalization of Circuits
4. Quick Fault Clearing
5. High Factor of Safety in Construction
6. Automatic Service Restorers
7. Higher Fusing of Transformers
8. More Lightning Arresters
9. Better Pole Preservation
10. More Guying

### Tree Pruning

Tree trimming looms unquestionably first among the practices which the utilities can apply to promote reliability of service. It is rated a primary factor by more of them. It is likewise called a secondary factor by fewer companies than any means of maintaining service continuity other than intensified inspection and maintenance. Furthermore, it was ignored in the replies fewer times than any other of the ten items offered for consideration. There were several replies that checked both the primary and secondary columns presumably to emphasize the importance.

Keeping the tree branches clear of the power wires is thus such a significant item that it would seem to warrant nation-wide emphasis. There could hardly be such unanimity of conviction on the topic if there were not also enough sound arguments on

which to base an educational campaign for the benefit of the public. The public that dotes on its trees also dotes on its electric service. It should not be impossible to explain that these two objects of affection are not incompatible—that there are ways of pruning the trees without disfiguring them —that the utilities have or can hire experts in the art of tree-pruning—and that it should not be necessary to resort to a more costly form of construction so that the trees can be preserved inviolate.

The municipals are somewhat more willing to rate the topic a secondary one than are the private utilities. This may be due to the fact that the city forester or tree warden is a brother municipal employee. There were several units in this group that indicated how important tree trimming is by checking the item in both the primary and secondary columns.

From both the private and municipal utilities come such phrases as "very important," "extensively done in the past but more is desirable," "favor hiring experts."

## Inspection and Maintenance

A close second to tree trimming as an instrument in promoting service reliability is an intensification of inspection and maintenance. It was accorded slightly lower preference as a first-place matter but it did show a bit higher rating as a secondary factor. Also it was ignored fewer times than any other topic.

Such comment as was made pertained mostly to the fact that the maintenance concept should be uncoupled from inspection. Quite noticeably, the companies insisted that their maintenance was up to requirements but that they could probably benefit by more frequent and intensive inspection to catch incipient defects before they develop into troubles that need emergency maintenance.

## Sectionalization

Sectionalization of circuits for the sake of isolation of faults is accorded third place of prominence as a contribution to service reliability. Again there were several who rated it high by calling it both a primary and secondary factor.

Sixty-three percent of the utilities and municipals combined (proportionately more of the latter) rate sectionalization of circuits in third place as a primary factor and only 12 percent failed to call it either a primary or secondary factor in service reliability. Small utilities were most unanimous and the large ones were least agreed on the issue; this is probably due to a preponderance of companies with sectionalization largely concentrated at substations rather than out along the circuits.

Comment was limited but mostly toward the end that sectionalization as something to apply to existing systems pertains mostly to the outlying and far-flung circuits that verge into rural characteristics. However, one utility which has a considerable number of such lines reported that sectionalization is of more importance on transmission lines than on the lower voltage distribution lines.

## Quick Fault Clearing

Clearing of faults as rapidly as practicable takes fourth place among the service reliability items. It was fourth in the "primary importance" columns, first in solely secondary importance (least mentions as secondary) and fifth in order of being ignored as not worthy of either primary or secondary importance.

Comment on this item was limited, mostly a reminder that, on distribution, the favored way is oftener to burn off the fault than to trip the circuit to clear the fault.

## Factor of Safety

There seems to be little disposition to use higher factors of safety in construction design in order to enhance the present values in terms of service reliability or continuity. The topic takes fifth place. There were several who accorded it no rating whatever in terms of things that need be done to insure service reliabiilty in post-war distribution. The attitude in that quarter seems to be that factors of safety are so thoroughly prescribed in regulations that focus should be directed at other things. There is definite comment that any higher standards than the present ones could hardly be justified economically. Taken in conjunction with the earlier comment regarding complication of design it is fairly evident that regulatory authorities may have to relax some of the more costly of the stipulated details if they wish to reduce distribution outlay and encourage low rates.

## Service Restorers

Automatic restoration of service falls into sixth place among factors conducive to continuity.

There were comments that there was call for more of the reclosing types of breakers and repeater fuses but some indication that improvement in fuse characteristics is still desired. Some indication exists that the "trek to the country" is going to expand the outlying circuits and that those suburbanite users, along with the farms and ruralites, will warrant adoption of extensive reclosing installations of appropriate types.

### Higher Fusing

The question of fusing of transformers, particularly whether the continuity of service would be improved by using higher fuse ratings in proportion to transformer rated amperes is not as clear cut as some of the items already discussed. This is quite naturally due to the fact that many companies are already fusing in what they consider is a relatively "high" manner. Naturally, if the comment is that "we fuse high now," there will be less disposition to consider the practice as one to be intensified or to accord primary importance to it for future practice.

Thus fusing to higher values is the first of the items which is definitely considered to be a secondary-importance factor in distribution service-continuity. In fact, several units urged that better coordination is a more useful objective than mere upping of the fuse ratings on transformers. Behind all this seems to be a growing realization that there is some optimum relationship between fuse blowings and transformer burnouts. One can be reduced at the expense of the other but where is the balance?

### Lightning Arresters

On the average the utility systems feel they have done a pretty good job in equipping the transformers and substations with lightning arresters. The item therefore falls into eighth place for future emphasis. It has relatively less attraction in it because the past has left comparatively little to the future to be done on existing systems. Absolutely, (in contrast with comparatively) the fact that nearly one in four of the systems assign the arrester a top place means that there is still much to do on existing lines and all to do on any new lines. Of course, the transformer which carries its own internal lightning protection decreases the call for external protection without in any way detracting from the importance of providing lightning protection in some effective form.

Among the supplementary remarks regarding lightning arresters were these; "Sufficient now," "vitally important but system well-provided," "little room for more; fully equipped," "leaning toward transformers equipped with protection," "very secondarily." Again there were a few, however, that called the arrester both a primary and a secondary influence in establishing good service reliability.

### Pole Preservation

Perhaps more a factor in promoting pole life than as a deterrent to service interruptions, application of preservatives is rated among the minor items that contribute to service reliability. Inspection usually catches the slow deterioration before it can be the primary cause of a line failure. As asked, the question carried the word "better" along with "pole preservation." That the future in this field can be looked at with relative complacency is indicated by the following remarks—"excellent already," "use the best we can buy," "present practice satisfactory," "trend this way," "satisfied, but will naturally take advantage of any better methods developed."

### Minor Factors

Quite minor among the things that can be done to sustain and promote continuity of service is the matter of pole-guying. This is undoubtedly because it is usually considered a component of the factor of safety objective previously discussed. It is one of the items covered in construction regulations and therefore is not left to much discretionary action. "We try to have plenty now," "present practice satisfactory," "doubtful value," "do not expect more," "neither primary nor secondary" are phrases which characterize the contentment with the present degree of guying insofar as it is an index of future trend.

Better grounding was volunteered by several as a field of activity which directly or indirectly abets service reliability as well as promoting safety.

# ADEQUACY OF DISTRIBUTION

Delivery of adequate and appropriately sustained voltage is a primary index of the adequacy of distribution and it is significant that the induction regulator held first place before the war and will retain the lead again after the war as a means of getting the voltage up and holding it there.

The capacitor moves rather startlingly—considering the large volume of activity in recent years—from ninth to second place. Multiplication of substations, particularly the unit types, comes third in importance.

Order of post-war importance by contrast with the pre-war preferences can be inferred from the accompanying table. If by "lesser" those reporting

meant a rank only secondary to the primary preference then the combination of "primary" and "lesser" tallies puts the capacitor in first place and larger conductors (probably secondary runs and services) in third place.

## Induction Regulator

First place, as has been stated, is given the induction regulator. Very few call it a secondary factor and more call it a primary factor than any other item in a list of 16 framed to disclose where the preferences lie in rendering distribution adequate in performance.

**Induction Regulator**

| | Pre-War | | | Post-War | | |
|---|---|---|---|---|---|---|
| | Primary | Lesser | Comb. | Primary | Lesser | Comb. |
| Large Utilities.. | 38 | 3 | 41 | 26 | 13 | 39 |
| Medium Utilities. | 38 | 2 | 40 | 32 | 7 | 39 |
| Small Utilities... | 5 | 1 | 6 | 6 | 1 | 7 |
| Large Municipals | 16 | 2 | 18 | 12 | 4 | 16 |
| Small Municipals. | 7 | 1 | 8 | 5 | 2 | 7 |
| Total ..... | 104 | 9 | 113 | 81 | 27 | 108 |

Despite the fact, therefore, that fewer systems rate the induction regulator as high in primary significance as they did before the war, it nevertheless outstrips all other approaches to sustained voltage adequacy for the post-war period. No supplementary comments were made, presumably indicating that the induction regulator is taken for granted as a functional device, capable, perhaps, of reduction of the idle band without necessarily incurring excessive operation.

## Capacitor

Close second to the induction regulator is the capacitor which more than doubles the entries in the "primary" column for the post-war period as compared with the pre-war. Adding in the secondary or "lesser" expressions the capacitor even outranks the induction regulator.

**Capacitor**

| | Pre-War | | | Post-War | | |
|---|---|---|---|---|---|---|
| | Primary | Lesser | Comb. | Primary | Lesser | Comb. |
| Large Utilities .. | 4 | 26 | 30 | 18 | 22 | 40 |
| Medium Utilities | 16 | 18 | 34 | 31 | 10 | 41 |
| Small Utilities .. | 4 | 2 | 6 | 6 | 2 | 8 |
| Large Municipals | 5 | 10 | 15 | 11 | 7 | 18 |
| Small Municipals | 3 | 4 | 7 | 6 | 5 | 11 |
| Totals .... | 32 | 60 | 92 | 72 | 46 | 118 |

The shift in attitude is noted in every category of utility size and ownership. It is two to one in most of them. Evidently the phenomenal increase in capacitors has not run its course and there will be extensive resort to them continued into the future. The attitude is that they release carrying capacity and ease the voltage-delivery problem but do not contribute primarily to voltage regulation in the restricted sense of the term.

Comments on the capacitor range all the way from "not for distribution" or "very few used" (there were few such in number) to the much more numerous comments "using more and more," "very valuable." In between there are indications that companies which have been installing capacitors will continue to add them insofar as it can be done, in most instances, without applying automatic on and off control. They have been used on long circuits on one system principally in thinly populated areas and rural districts. In another they are viewed as contributing added circuit capacity, particularly "if the load factor is improved." In another (medium-sized) utility system the capacitors are considered to boost the voltage and to better the power factor with a view to holding down the amount of

**Factors in Distribution Adequacy**

| Pre-War Order | | | | Post-War Order | | |
|---|---|---|---|---|---|---|
| Principal | Lesser | Combined | | Principal | Lesser | Combined |
| 1 | 16 | 1 | Induction Regulator ..... | 1 | 13 | 2 |
| 9 | 2 | 4 | Capacitors ..... | 2 | 4 | 1 |
| 4 | 15 | 10 | Add'l. Substa. ..... | 3 | 16 | 6 |
| 7 | 3 | 5 | Step-Regulator ..... | 4 | 11 | 4 |
| 6 | 5 | 6 | Extend 3-Phase ..... | 5 | 8 | 5 |
| 8 | 11 | 11 | Higher Voltage ..... | 6 | 14 | 8 |
| 2 | 8 | 2 | Generator Bus Reg'n. ..... | 7 | 5 | 7 |
| 5 | 13 | 8 | Change Delta to Wye..... | 8 | 10 | 11 |
| 10 | 4 | 7 | Tap-Changer ..... | 9 | 6 | 9 |
| 3 | 9 | 3 | Larger Conductors ..... | 10 | 2 | 3 |
| 11 | 7 | 12 | Banked Secondaries ..... | 11 | 3 | 10 |
| 13 | 12 | 14 | Secondary Network ..... | 12 | 9 | 14 |
| 12 | 10 | 13 | Run Loop Feeders ..... | 13 | 7 | 12 |
| 14 | 14 | 15 | Primary Network ..... | 14 | 12 | 15 |
| 16 | 6 | 16 | Low-impedance Transf. ..... | 15 | 15 | 16 |
| 15 | 1 | 9 | Fixed-boost ..... | 16 | 1 | 13 |

transformer kva. required; if this is not done it will ultimately result in reducing the kilowatt capacity of generating stations because of the kvar. burden.

Sole comment from municipals was the remark that customers are induced to install capacitors.

## Substations

Adding of substations and splitting up of areas and circuits evidently is going to be one of the prominent ways of keeping distribution abreast of the load. It takes third place after having held fourth place in the pre-war era. However, it stands last in secondary significance and that throws it into sixth place if the two attitudes are combined.

**Added Substations**

| | Pre-War | | | Post-War | | |
|---|---|---|---|---|---|---|
| | Primary | Lesser | Comb. | Primary | Lesser | Comb. |
| Large utilities... | 24 | 8 | 32 | 28 | 8 | 36 |
| Medium utilities | 19 | 7 | 26 | 25 | 9 | 34 |
| Small utilities... | 1 | 2 | 3 | 3 | 1 | 4 |
| Large municipals | 4 | 5 | 9 | 7 | 4 | 11 |
| Small municipals | 4 | 1 | 5 | 7 | 1 | 8 |
| Totals .... | 52 | 23 | 75 | 70 | 23 | 93 |

Here again the addition of substations, largely in an effort to bring high voltage nearer to the load by shortening the lower voltage circuits, is viewed with greater favor by all groups of utilities than before the war, without exception. They are reported to be the solution when feeders get too long or too heavily loaded. In some cases, however, the utility is well supplied now with substations and sees no need for more in the dubious post-war period for its communities.

## Step-Regulator

In increased favor too is the step-type regulator as a means of making minimum distribution suffice from the voltage standpoint. Each category of utilities in the five arbitrary classifications shows an increased number ready to accord it fourth place as a tool of primary usefulness. It also takes fourth place when "primary" and "lesser" tallies are combined.

Here again it moves into more thoroughly clinched first-rate importance for the future in every group without exception. Several companies report they have none, however, and others indicate they choose the step-type for long rurals stretching out of suburban areas, apply them at small-community substations or use them where close regulation is not of paramount importance.

## Extend Three-Phase

Extension of three-phase circuits as a way of enlarging the competency of distribution is another way that is almost universally rated as of greater significance in the post-war era. All but the small municipals feel that way about it as a group. In some cases, the weight of preference is almost doubled.

A few of the medium-sized utilities say that extension of three-phase circuits has been pretty well carried out and this is apparently true of the small municipals because of their commonly compact layout. It is essentially the larger utilities which offer the principal field for extension where the single-phase circuits are unbalanced or insufficient capacity. It is again a matter of voltage adequacy rather than of voltage regulation in the strict sense of the definition.

## Higher Distribution Voltages

Interest in the use of higher voltages for distribution circuits is unmistakable even though it is not wholly clear how much of the interest is wrapped up in the familiar delta-to-wye gains that put handling on a 4,160- instead of a 2,400-volt basis (that was a separate item to be discussed later).

It is being studied in several quarters and in some places the boost from such voltages as 6 kv. to 11 kv. is considered possible or even at the stage of being contemplated. One system says the possibility of justification was hardly in sight nor was the raise expected at any foreseeable date, nevertheless the system had been designed to accommodate a higher voltage and the tone is evidently one of satisfaction that that was done. There are a few systems which say they cannot justify a higher voltage.

## Generator Bus Regulation

Manipulation of generator voltage seems to be in some favor as a means of holding service-entrance voltages up by keeping abreast of the loading. It is particularly true of systems that are less committed to ties with other systems that then have to use the voltage to control kilovar transfers. The increase in the number of such ties during the war and the prospect of their retention or increase is a deterrent to use for local voltage purposes. At least the number of utilities and municipals according first place to generator bus regulation is less for the post-war than the pre-war period.

One of the common comments is that the practice is to hold flat voltage at the generating stations. There was no mention that concerted action by interconnected companies might more frequently have the "flat" voltages manipulated somewhat so as to relieve the burden of regulation on distribution equipment.

## Change Delta to Wye

Conversion from delta to wye has been largely completed on some systems, according to the reports, but the potentiality apparently still exists in sizable magnitude. It rates eighth in prominence among things that ought to be observed to make and keep distribution adequate. In fact, there is a shade more emphasis on it for the post-war period than it had pre-war.

"Completed," "already done," "none to do," "all wye now," "no delta left," verge into "only a few district to do" and finally into "will be done for load reasons" (in contrast to voltage regulation). One large municipal, however, says the conversion from 2.4 and 4.1 kv. to 4.8 kv. will continue. One large utility simply said "do not favor the conversion" but no arguments were appended.

## Tap-Changing Transformer

Tap-changers, while much more a transmission tool than classified as distribution, do have the ability to assist in controlling voltages down into the distribution brackets. This is borne out by contrasting comments "not much for distribution, expect to increase for transmission" and "does have some effect on distribution voltages." At any rate, the tap-changing transformer, while not a prominent factor in aiding distribution adequacy or distribution voltage regulation, is rated superior in importance to banking, networks and enlarged conductors.

Large municipals and medium-sized private utilities seem to see much more in the tap changer than the other groups when they look at the problem of distribution.

## Larger Conductor

Among the minor items pertinent to providing adequate distribution is that of adopting or changing to more generously cross-sectioned conductor. It stands tenth in favor in the post-war rating. Anyhow, most of the artifices of the economics engineer in distribution are viewed as averting the use of inordinate amounts of copper in conductors.

If, however, primary and lesser significance are combined, the resort to enlarged conductors moves up into third place, inferior only to induction regulators and capacitors.

## Banked Secondaries

As a practice, banking of transformers or secondaries is something that divides the industry into two quite well-defined camps. There are those who are "sold" and there are those who just say "it is not done," implying that they do not believe in it. However, in any event, banking will probably be accorded more recognition in the post-war period inasmuch as an enlarged number of systems are rating it of primary importance.

**Banked Secondaries**

| | Pre-War | | | Post-War | | |
|---|---|---|---|---|---|---|
| | Primary | Lesser | Comb. | Primary | Lesser | Comb. |
| Large Utilities .. | 9 | 16 | 25 | 19 | 19 | 31 |
| Medium Utilities | 3 | 23 | 26 | 10 | 18 | 28 |
| Small Utilities .. | 2 | 4 | 6 | 3 | 3 | 6 |
| Large Municipals | 4 | 5 | 9 | 4 | 4 | 8 |
| Small Municipals | 3 | 5 | 8 | 4 | 4 | 8 |
| Totals .... | 21 | 53 | 74 | 40 | 48 | 81 |

There is more change in heart among the private utilities than among the municipals. What lukewarmness there is, other than coupled with unfamiliarity with banking practice and principles, is linked with such remarks as just "no" or "none," "system personnel not used to banking," "not planned." There were, on the contrary, such comments as "expect to extend use," "in urban areas," "considering favorably."

One company says it "could not be hired to tie secondaries together without fuses but might bank more if automatic sectionalization becomes attractively available." Another holds to radial distribution for the suburbs and rural areas but uses secondary banking in the urban residential and commercial areas where there are overhead lines. The secondary network rules in the heavy commercial areas where the primaries are underground.

## Secondary Networks

While limited primarily to business sections and other areas where there is justifiable load density the secondary network shows appreciable gain in favor for the post-war era. Not so much, however, as not to leave it in twelfth place among 16 items. As might be expected, because of the appropriateness for underground construction, the major interest resides in the medium and large systems.

Two systems report having a few possibilities for using a modified form of secondary network in outlying areas with less load density than in the business sections where commonly applied. Generally, however, the attitude is that, as a means of handling the load and the voltage requirements, the secondary network has limited potentiality except for underground systems.

## Looped Feeders

Diversity of practice and attitude marks the issue of looping the feeders to promote adequacy as well

as reliability of service. It is well down toward the bottom of the list and shows only about one-fifth of the systems calling it an important factor in the distribution pattern.

Some companies have looped feeders in a few instances but others say that instead they plan to provide more back-ups of other nature. In one instance it is reported done only on 13 kv. and higher-voltage circuits but in another on the 2.3 kv. network as well. Several companies took pains to assert that they do not indulge in the practice.

## Primary Network

The topic of the primary network provoked more discussion than any other single item on the whole questionnaire. Nevertheless, the expressions about its potentiality for providing an adequate distribution system economically are such as to place it next to the bottom of the list. Only one other item (fixed boost) was accorded less prominence as a primary item.

**Primary Network**

| | Pre-War | | | Post-War | | |
|---|---|---|---|---|---|---|
| | Primary | Lesser | Comb. | Primary | Lesser | Comb. |
| Large Utilities .. | 3 | 12 | 15 | 11 | 11 | 22 |
| Medium Utilities | 7 | 9 | 16 | 11 | 9 | 20 |
| Small Utilities .. | 0 | 2 | 2 | 1 | 1 | 2 |
| Large Municipals | 2 | 3 | 5 | 3 | 4 | 7 |
| Small Municipals | 2 | 5 | 7 | 3 | 5 | 8 |
| Totals .... | 14 | 31 | 45 | 29 | 30 | 59 |

Those who are "unsold" use such expressions as "none," "none now" or plain "no." Others say "little used," "doubtful at present" or "have used to minor extent." In the moderately disposed groups are those who are semi-connected now and, cautious about circulating currents, are making slow progress in tie-ins. Others look favorably only with regard to medium-sized communities. Even then in the interest of present continuity they prefer to provide two-way primary circuits to serve the areas wherever that can be done. Others have no plans for primary networks in suburban areas while, however, having plans for a modified form in heavily loaded industrial areas; even there there will first have to be pronounced load increases and that "may take 10 years." One utility has such a small industrial primary network and may build another.

In brief, there appears to be little interest in the primary network for suburban areas under present load-density conditions. Not a few state they much prefer adherence to radial philosophy. One attitude is to supplement transmission substations with unit-type substations in growing areas; ultimately these stations might, however, be tied together in some form of primary network. No network is planned, on the contrary, on a system which contemplates relocating or building lower-voltage transmission to simplify the pattern of local distribution. The primary network is not, however, deemed feasible in comparison with increasing the copper and spacing the transformers closer together because these measures will suffice for some time on certain systems. Still others have no immediate plans but have made provision for future primary network operation by laying out the 13/4-kv. stations to accommodate such a conversion.

## Incipient Programs

Evidence that modest beginnings have been made arises from the mention of "one small primary network" in several of the reports. Modifications or stepping-stone stages are implied in other cases. In one instance the substations merely require enlargement to provide for load growth; the system "is interested in tying existing substation facilities together through banking of primary feeders if satisfactory tie-switching should become available at an economical price level." Another company's 12-kv. network needs only a few tie circuits and sectionalizing circuit breakers plus a few new 66-kv. feed-in substations. Here a small increase in 4-kv. network is expected; it will chiefly require circuit breakers and some new substation units.

Among the unconditionally favorable systems is one which plans to extend the primary networks each time a unit substation is installed. Locations are usually near the metropolitan limits and the circuit arrangement is such that the primary lines extending out into the rural-suburban areas are usually radial circuits while those extending into the city are usually made part of the city primary network. This primary network can be considered a modified version in that the substations are installed, the existing primary circuits are opened and tied into the new substations.

## Modified Forms

Strong indeed is one company's belief that very general use will be made of primary networks for both urban and suburban areas. Another feels, less strongly, that economies will govern but that there is a field in conjunction with low-cost factory-assembled units. Another company plans to apply primary networks to all feeders in suburban areas and their trend is toward that practice for all 4-kv. feeders. Still another's entire 4-kv. distribution system now operates, with some isolated exceptions, on a modified form; plans contemplate only normal reinforcements and additions to meet new load demands. In another case of a medium-sized utility there is contemplation of sizable amounts in suburban areas, particularly where they lie adjacent to presently served communities; isolated areas will continue to

be radial. A municipal is giving serious consideration to the primary network for growing outlying areas, feeling that it may offer economies over the conventional three-phase four-wire radial system.

Example of transition approach is found in the case of a utility which plans to establish four small substations near new load areas and they will afford a back-feed into existing circuits which may then be sectionalized for normal operation. In some cases ties will be maintained with the original station, especially if it has a generator or synchronous condenser for voltage control. This tie may be on disconnects, a pole-top circuit breaker with directional relays, or by fuses. The latter cases may preclude automatic maintenance of service for loss of the normal supply but will improve voltage control and lower the impedances.

A summary of the status of the primary network is given in the accompanying table:

**Primary Network**

| | Utilities | | | Municipals | |
|---|---|---|---|---|---|
| | Large | Med. | Small | Large | Small |
| Conventional | | | | | |
| Adoption or extension planned ... | 7 | 3 | 0 | 1 | 0 |
| Under discussion .. | 2 | 1 | 0 | 1 | 0 |
| No plans ..... | 25 | 23 | 5 | 12 | 4 |
| Not answered .... | 11 | 17 | 4 | 19 | 11 |
| Modified | | | | | |
| Adoption or extension planned ... | 6 | 4 | 0 | 0 | 1 |
| Under discussion .. | 5 | 4 | 0 | 0 | 1 |
| No plans ..... | 19 | 17 | 5 | 13 | 4 |
| Not answered .... | 15 | 19 | 4 | 10 | 10 |

### Low-impedance Transformer

Rather uncertain reaction was obtained regarding the query about the practicability of transformers with lowered impedance. At least, the acknowledgement of primary importance to this means of enhancing the adequacy of distribution and improving voltage regulation was so scant as to put it near the bottom of the list from any standpoint. It does win more notice, however, for post-war than it had earned as a pre-war interest.

While one large utility says that a low impedance distribution transformer would be desirable if it could be made available, others prefer 5 to 6 percent impedance to hold down short circuit currents. Others are doubtful, say "no," or "no difficulty" and anticipate no change. There was one mention of welding loads as warranting transformers with lower than normal impedance.

### Fixed Boost

Definitely negligible or at least very secondary status is accorded to fixed boost as a measure to employ in connection with voltage problems. For the post-war period it got more "lesser" tallies and fewer "primary" than any other item, quite naturally because of its limitations.

The only item mentioned to supplement the query list of 16 was the synchronous condenser which, on the transmission system, can contribute as does the capacitor to regimes which aid the flow of kilovars and help maintain the voltage levels needed for distribution purposes.

# UNDERGROUND

### Resumption of Activity

Generally speaking, a post-war resumption of activity in underground construction is expected by slightly less than half the private utilities and considerably more than half the municipal systems. Most of the positive mentions, however, are qualified by remarks indicating that the volume is expected to be limited or at most not extensive; phrases are "moderate," "minor," "not substantial." Several which reported no prospective activity are systems which at present have no underground.

Such construction as is expected will hardly in any instance, according to reports, be justified economically by load density although a few of the municipals and one of the medium-sized utilities say it can be partly justified for the projects in hand. Many more (including some municipals) say outright that load density does not substantiate underground costs independently of all other considerations.

**Expected Resumption of Underground Activity**

| | Some activity | No activity |
|---|---|---|
| Large Utilities ..... | 20 | 18 |
| Medium Utilities ..... | 10 | 24 |
| Small Utilities ..... | 2 | 6 |
| Large Municipals ..... | 16 | 5 |
| Small Municipals ..... | 6 | 6 |
| Totals ..... | 54 | 59 |

## Underground Practices

Responses indicate by a large preponderance that no sharp change is expected in the form of such underground facilities as are built in the post-war era. Several, however, indicate that they are open to progress even though they adhere to present conventions. Only three units said no to the question "do you expect to follow pretty much the construction practices of the past?" and they did not explain their answers.

An equal preponderance was manifested regarding the simple resort to buried cable without ducts—there were only 10 out of 135 units that expressed any interest and that was usually "some," "moderately," "not sure," "limited," or "street lighting only." One municipal indicated an intention to go to burying to some extent for house services. Generally, however, the answers were simply "no" and to the number of 93 altogether.

One utility will prefer synthetic-insulation, non-leaded, Neoprene-jacketed cables in ducts because it is considered difficult to locate faults in buried cable. Elsewhere the experience with buried or parkway cable has been generally satisfactory, 22 kv. down. Another reports the same "when properly applied" and says nothing adverse about location of faults. Still another says there has not, in its system, been a single case of trouble in some 30-mile years of experience with use on series street lighting; parkway or similar trench-lay cable has not, however, been tried there for primary or secondary service. Proper lightning protection is mentioned by one utility as a prerequisite to successful performance. One city utility has used buried cable to a limited extent for street lighting and for distribution in a few isolated housing developments. Performance has been generally satisfactory but the method is not favored for use due to the limited number of situations "where cable may be buried without paving or repaving."

One medium-sized utility reports favorable experience with the lead-covered, steel-taped type of buried cable but poor results with the non-metallic variety. A Northern utility says buried cable is more difficult and slower to repair, especially in winter with two feet of frost in the ground. The non-metallic type has given generally good service, however, in some locations where the soils have proved corrosive to both lead and steel-taped cables.

Buried cable proved satisfactory but more expensive in the long run on one municipal system. Another's buried cable suffered mechanical damage. Still another says the parkway kind has given no trouble from inherent causes whereas the trenchlay has given much trouble and calls for complete replacement about every twelve years. Damage by tree roots has been an added adverse experience on a utility system; there the present and future practice is committed to pull-into-duct design.

## Cable Sheathing

There are practically as many who report favorable intentions on lead-covered and on non-metallic sheathed cable. On the other hand, there are just as many on each issue who flatly say no. In short, there is no such clear cut delineation of camps as to show a preponderance in favor of either. Naturally, perhaps, there is frequent stipulation that lead is favored for the primaries and non-metallic sheathing for the low voltage uses. However, there is considerable doubt tacked, by such phrases as "probably not," "possibly," "some," etc., to the answers regarding non-metallic sheaths. On the contrary, there is a more frequent use of such terms as "exclusively" and "definitely" in connection with lead-sheathed cable. The explanation of the reticence regarding use of non-metallic sheath cable is hinted in supplementary comments which question whether synthetic materials will "prove their value in the next two or three years." Quality of the synthetic insulations and their performance is "indeterminate" at present in the opinion of another utility. A large utility favors the lead-covered cable for most underground construction and has "no knowledge of anything of equal performance but when such competitive equipment becomes available at less cost, will be glad to use it."

## Vaults and Ducts

Well over half the distribution systems will cling to conventional duct and vault construction but about one in four favors use of ducts for the lines and transformers on poles, in customer vaults or in kiosks, etc. About 12 percent will have situations warranting putting the transformers in vaults in conjunction with circuits run overhead. Both these latter alternatives are generally limited in scope by comparison with the extent of the conventional procedure.

One medium-sized utility does say it will place the transformers overhead and use ducts for the circuits to a large extent in residential areas and another will do it on some streets to avoid large vaults. A larger utility will do it some in connection with networks and in residential districts whereas another will do it only in special cases.

The reverse procedure will be studied by a municipal in the belief that it may prove economical in many areas to put the transformers into vaults while avoiding duct runs by keeping the circuits overhead. One utility contemplates having the primary underground but having the secondaries in the air.

# TRANSMISSION

Expectation that prospective loadings will necessitate the building of transmission circuits over new routes is reported by 47 utilities and municipals and only 6 altogether have no such expectations for the early future. However, some of those who give affirmative indications remarked that the likely program is modest in scope. Most of the large and all of the medium sized utilities feel they will have call to erect new lines but they are likewise the groups from which come the comments that indicate a limited volume of activity. In a couple of instances the alternative appears to be an increase of conductor size on existing lines although no details are vouchsafed.

Doubling up of circuits, it is reported, is pretty well an achieved fact on many systems and this accounts for the result that fewer than half the utilities are likely to add circuits to existing structures. The medium utilities are quite a bit surer of doing this, however, than the large ones.

Raising of voltage on existing lines is a prospect with half the utilities and in this instance it is equally true of all three groups. Nevertheless, several say that it will be done in only a few cases and at none too certain a date.

## Enchanced Reliability

Of almost equal importance with provision of additional circuits is the improvement of existing facilities so that their reliability can be counted upon and make additions less necessary. In this field the outstanding desire and objective is faster relaying.

The order of importance attached to these items proves to be as follows:

1. Faster relaying
2. Lowered ground resistance
3. Better insulation coordination
4. Additional ground wires
5. Application of expulsion tubes
6. Tie-line load control
7. Higher values of insulation
8. Stability correctives

In general, the plain "noes" were the largest in number for the measures which stand low.

## Relaying Speed

There were only four utilities which indicated they are not interested in faster relaying but there were from 16 to 19 among the 59 utilities that said that about all the other possible measures. Two of those who said "no" added that they had recently speeded up the relaying on their transmission network. In general there were few qualifying remarks from those that look forward to faster clearing of faults; one said that it would be wanted only for 132-kv. lines, however. There was mention of carrier in some of the replies.

## Ground Resistance

Substantial interest is manifested in obtaining lowered ground resistance. It is placed quite high in the scale but 15 of the replies (one-quarter of the total) indicated, nevertheless, that there was no appreciable interest. Four indicated that they felt they had attained satisfactorily low ground resistance on their systems and one very definitely said the values had been brought to the economically justifiable minimum. Some who expressed the desire for lower values of ground resistance were skeptical of achieving the desired minimum values.

## Better Insulation Coordination

Third in importance is the objective of completing the coordination of insulation in keeping with what has been learned about the matter in the last decade or so. Three municipals consider that they have their insulation adequately coordinated and 10 out of 30 large utilities apparently are in the same position because they indicated negligible interest. Such interest as there is comes largely, therefore, from the rest of the large utilities and the bulk of the medium-sized ones. While speaking of coordination there was, as in the distribution report, the reminder that transmission can profit by better coordination of breakers and fuses.

## Additional Ground Wires

Addition of ground wires (or counterpoises as reminded in some reports) is of reasonably significant importance in connection with lines not now adequately provided. Again in this instance there was indication that many existing lines are considered adequately shielded and even some of the favorable answers carried a "possible" qualification. There was one mention of contemplation of a Petersen coil.

## Expulsion Tubes

Relatively minor interest is manifested in the application of expulsion tubes to existing lines. Only 9 of the 59 reports indicated consideration of the measure and more than half of those were qualified by statements that the activity would be limited or that it would be applied in certain special cases. The ratings in the scale fell largely into third to fifth place among the eight items under consideration. Some of the negative attitudes were coupled with the statement that the program of putting expulsion tubes on the lines had been 80 to 100 percent completed. Others are studying the possibilities but some are not even doing that because the probable ampere loadings are too heavy for the 66-kv. lines in question or that they are "not needed on wood H-frame lines."

## Tie-line Load Control

Ten utilities and municipals express an undefined interest in tie-line control and thirteen more rate it all the way from second to sixth place in the scale of the eight items. One large unit is now installing tie-line load control and some carrier relaying to improve the speed and selectivity of relaying on present lines. However, among the favorable indications there are comparatively few that restrict the interest to limited scope or a "perhaps" status. Nineteen merely said they were not interested and where reasons were given it was because they had more or less recently installed such facilities or did not consider that they were needed.

## Other Reliability Measures

Two other measures for enhancing the reliability or capability of existing transmission lines were those of applying higher insulation levels or any form of correctives for stability. Neither won much accord. Only five utilities indicated interest of a general nature and twelve gave it definitely inferior rating among the factors. Frequent mention was to the effect that the program was complete or that it was covered by what had been done in coordinating the respective insulation levels.

Stability is reported to be no problem from the transmission standpoint as indicated by comments that it is satisfactory in that the need for correctives is not evident.

## Capability Measures

Ties are expected to be added to improve system handling and interchange by more than twice as many utilities and municipals as those who do not contemplate them. It is none too positive an intention, however, for all the 38 units because several indicate the action only as possible or contemplated in a preliminary way. Others say it depends on the growth of load and still others say it is too dubious to predict much activity at the present time. Flat-footed denials came from 17 utilities (9 large and 8 medium-sized) and coupled with two of these were such statements as "none in sight" or "now adequate for years to come."

Prospect of any higher voltages than those on the 220- and 287-kv. lines now in use is exceedingly slim. Only a single company admits interest in the technical feasibility and economic practicality of a higher voltage. Against this there are 48 utilities and large municipals that say have no such plans in mind.

An almost parallel situation exists with regard to adoption of d.c. transmission. There is a possibility of adoption in just one instance and along with it a "maybe" advanced in an additional case. There are 45 negative answers and among these are some which disclose that not much thinking has been devoted to the possibility; "insufficiently advised" indicates that lack of thinking is due to lack of information in some quarters about the economic merits of d.c. transmission.

## Structural Material

When the stringency as to timber products will have passed as that for structural steel is already passing, there will be strong preference for retention of wood for transmission line structures but with it a parallel determination to revert to steel above certain voltages. The question was "above what voltage are you likely to revert to use of steel instead of wood for higher-voltage line structures"? From the tabulated data there is some ground for suspicion that the answer was based on "at what voltage" rather than "above what voltage."

At any rate, it is in the 110-132 kv. principally and 66 and 154 kv. brackets secondarily that the switch back to steel is indicated as a good possibility. Against this trend can be set a few "no reversion" indications of a positive nature and a considerable number of varied attitudes. These range from a preference for wood at all voltages if it can be obtained and will meet the requirements to a choice for steel for double circuit lines of either voltage. Another (large) utility says "would revert to steel only where justified by the importance of the circuit and the degree of heavy mechanical loading encountered." All in all the insulating value of wood seems to have taken hold to give wood an occasion to invade a province earlier reserved for steel structures. Steel holds its own for the higher voltage brackets and where exposure or mechanical loading are ruling factors.

# For Unskilled Testers

***Semi-automatic meter test board compensates for war-time shortage of experienced testers — Operations greatly simplified***

*M. W. BEVINS, Meter Supt., Public Service Co. of Oklahoma*

THE SEMI-AUTOMATIC meter test board shown, developed and used on the system of the Public Service Company of Oklahoma, is the outgrowth of a wartime shortage of skilled meter testers. It provides a near "foolproof" meter test device which can be carried to outlying system divisions and set up in company storerooms.

The board is universal in application. While it is used in the main for testing 120-volt A-type meters, it can be used for testing polyphase meters as well. Voltage range available in the board is 120, 240, 480 volts. Current settings provided include $\frac{1}{4}$, $\frac{1}{2}$, 1, $1\frac{1}{2}$, $2\frac{1}{2}$, 5, 10, 25 and 50 amp. Meter constants on a 120-volt, 5-amp. basis are $\frac{1}{2}$, $\frac{5}{12}$, $\frac{5}{10}$ and $\frac{6}{10}$. Multipliers take care of meters with other than 5-amp., 120-volt rating.

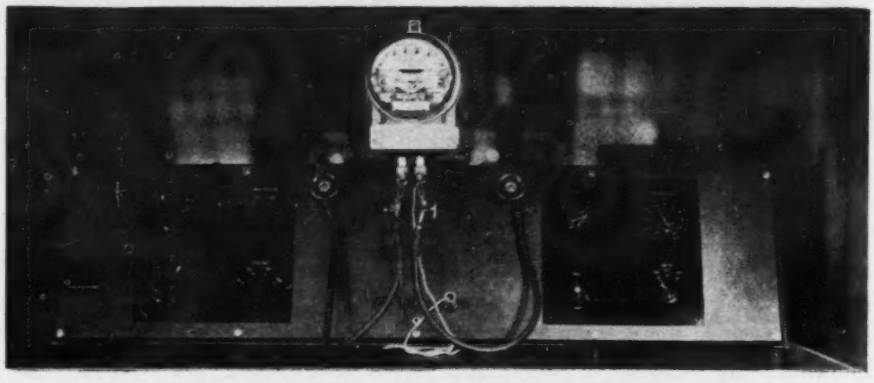
Since a rotating standard is incorporated in the test board, it is not necessary to use a separate standard in the field. However, it is tested and calibrated, after transporting, with a shop standard, and tested periodically while in use. The built-in standard consists of a watt-hour meter element and current transformer. The current transformer has suitable taps on both primary and secondary so that the standard may be used with a meter of any current rating or watt-hour meter constant.

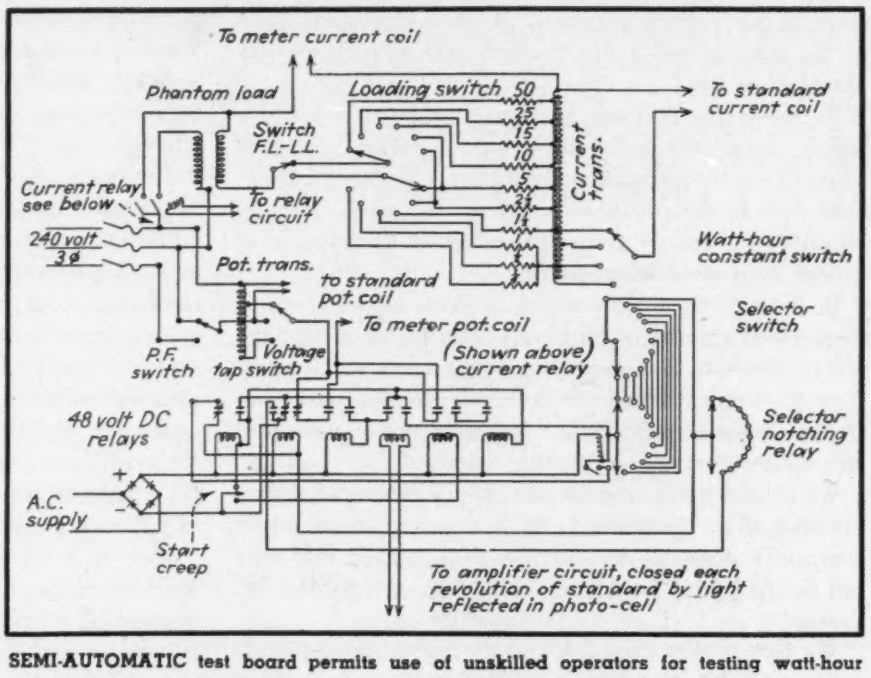
A mirror mounted on the shaft of the standard reflects light into a photo-electric cell once every revolution. By means of an amplifier circuit and suitable relays this light is used first to start the meter under test by closing the current and potential relays and then stop it after a certain number of revolutions, determined by the dial setting. Secondary taps on the current transformer make it possible to obtain an even number of revolutions of the meter regardless of type. The stopping relay kills the entire front of the board, making it unnecessary to open or close the power switch when changing connections.

Several advantages can be listed for this type of portable test board:

1. Ease of operation. It is not necessary to calculate revolutions of different types of meters. Skill in snapping a test switch is not required; beginners are easily and quickly trained.
2. The board requires no attention while it is running. Other work, such as sealing meters or recording test data, can be done by the same operator.
3. Accuracy in starting and stopping the test meter with the photo-electric cell eliminates human error. Less revolutions are required and thus testing is speeded up.
4. Since the watt-hour element of the standard has no train to run and since it normally operates between 5/6 and 1.5 times full load in the straight line portion of the load curve, over-all accuracy is exceptional and variation due to friction is negligible.
5. The load switch changes taps on the current transformer at the same time that it changes the current. Therefore there is no possibility of injuring the standard from overcurrent or overvoltage.

Using this test board it is possible for operators to test up to 130 new meters in one day. Old meters, requiring considerable adjustment, can be tested at the rate of 50 per day. Arrangements are being made for the Nelson Electric Company, Tulsa, to manufacture these test boards.






**SEMI-AUTOMATIC test board permits use of unskilled operators for testing watt-hour meters; temporary meter shop can be set up in such locations as division storerooms**

# Editorials

S. B. WILLIAMS, *Editor*

## *Who Will Market Future Federal Hydro Power*

A FEDERAL WATER POWER PROGRAM is in the making which eclipses anything so far undertaken. Acceptance of the program is asked at this time with appropriations to come later from time to time. Because so many areas are involved it seems unlikely that Congress will turn the program down.

The big question that must be answered, however, is how the power is to be marketed. In few of the areas under consideration for development does a market now exist. It will be argued, of course, that the same question arose in each of the previous government hydro developments, but all seem to be doing pretty well. That argument, however, will not be so valid once the government stops its war buying program. When that happens most of the government hydro projects will have great surpluses of power.

To move this post-war surplus, as well as that which will be developed under the present program, will need a lot of sales imagination and initiative. To buy up utility businesses in the area is no solution. It merely provides an outlet for energy from one source at the expense of energy from some other source.

In the past these government projects have brought a tremendous amount of bitterness between the public and private interests. Is invasion the only way by which power from government dams can be developed and marketed? Or may it not be possible to develop the power sources of an area cooperatively by the two interests?

We believe it can be done and should be done, but does Congress share that belief? What have the private power companies done to demonstrate to Congress that they can do the job of marketing better than any government agency?

We believe that Congress and the rest of the nation is weary of fighting and wants to find some way of doing this job peaceably. There will, of course, be a powerful opposition from the public power advocates to private business having any part to play in the disposition of government-generated energy, but we believe Congress is willing to be reasonable if a little selling is done.

If the private power utilities are willing to enter into an agreement for the marketing of power from federal hydro projects, they should be ready to offer a basis that is fair to all concerned—a basis designed to move this power just as quickly as though it was of their own generation.

If this is done we do not believe that Congress will demand of the private utilities the kind of contracts that will give the government a throttle hold on their business or their properties. There is no reason why this should be a one-sided agreement because each side has so much to gain by a fair arrangement.

Because this whole matter involves the determination of a broad policy the presentation of the utilities' case should be an industry job and not left to a few individual companies. The preparation of the utilities' case should begin now. Perhaps by the time it is completed the industry may have found some way to have a recognized voice in Washington to present it.

## *The Heat Pump as a Residential Load Builder*

ATTENTION was drawn at the recent annual meeting of the Edison Electric Institute to the heat pump as a residential load builder that could dwarf all other major home appliance loads combined. For years heating by electricity has been studied and many installations made, particularly where abundant water power was available. While it is attractive from the standpoint of cleanliness and low maintenance requirements it has nevertheless been expensive, even at rates of less than one cent per kilowatt-hour.

The heat pump, on the other hand, does not use energy directly for heating; it pumps low-temperature heat from outdoor air or from well water into the space to be warmed where it is released at a higher temperature. In that way a co-efficient of performance of 3 to 5 over straight energy conversion is secured which permits the heat pump at one cent per kilowatt-hour for electricity to be fully competitive with $10.20 coal of 12,000 B.t.u. quality or $11.90 coal on a 14,000 B.t.u. basis, or with 550 B.t.u. manufactured gas at 23.4 cents per thousand cubic feet or 1,000 B.t.u. natural gas at 42.4 cents, or with 125,000 B.t.u. oil at 5.2 cents per gallon.

This is a little more expensive than coal but thousands of homes have turned to more expensive fuels for reasons of cleanliness and convenience and with electricity surpassing all others in this respect it can be expected to enjoy the same acceptance.

The annual energy consumption of the average six-room house using the heat pump is estimated to be around 10,000 kw.-hr. This includes both heating and cooling. At one cent per kilowatt-hour this isn't very expensive, especially so when it will also cut the cost of hot water in two.

These estimates are based upon a limited number of installations and in all probability could be bettered decidedly with more installations and more research. The load possibilities are so big as to warrant immediate study by the industry on a large scale.

## Treasury's Statement on Rate Reductions vs. Taxes

THIRTY-ONE INSTANCES of rate reductions have been reported since the first of the year, aggregating annual savings to customers of approximately $11,500,000. The largest reduction is the five-million dollar slash by New Jersey Public Service announced last week. There are in addition a few sizable reductions that have been ordered but are in dispute, while a number of hearings that may produce very significant results are in process.

The reports do not indicate how much effect the excess-profits taxes now being paid by utilities had in bringing about these reductions, but whatever it was, it can be expected to be greater as the result of the statement this week of the Secretary of the Treasury. Mr. Morgenthau said that the Treasury Department "does not wish to be considered as giving even tacit approval to the suggestion being made in some quarters that public utility rate reductions should not be put into effect because one result would be a loss of Federal revenues, particularly through reduction or elimination of Federal excess-profit taxes."

The Secretary takes the position, and quite properly so, that rate making is a responsibility of commissions set up for that purpose. But by leaning over backwards so very far his statement virtually invites regulatory bodies to order lower rates without fear of criticism of their patriotism.

While this might not embarrass the Treasury to any substantial degree because excess-profits taxes are not expected to continue much, if any, beyond the end of the war, it can complicate matters no end for the utilities.

The great reluctance of the utilities to rate reductions at this time is not in the immediate effect of the loss in revenue because this is nullified to a great extent by taxes. The difficulty lies in the permanence of a lower rate.

This might be a good time to give more attention to the customer dividend method of returning excess earnings. The government is using this very extensively, only calling it recapture by renegotiation. When the war is over and operations are once more on a normal basis, companies will know how much if any of this war dividend can be reflected in permanently lower rates.

## The Economics of Sectionalization

WHILE CONTINUITY of service is something which the public has come to take for granted, so well have equipments stood up even under the stress of war-time duty, there is a question whether the added loads of the future might not make it more essential than ever to minimize interruptions and their effects.

Is it necessary, however, to provide as close to 100 percent continuity as possible throughout the entire system at great cost, or can a practical result be achieved at much less cost by minimizing the area of disturbance? Shall it be super-quality construction and little sectionalization or extensive sectionalization and just a good standard of physical construction?

Sectionalizing is going to predominate on urban systems and particularly on rural distribution systems just so far as the sectionalizing devices lend themselves to an inexpensive and positive way of confining disturbances to small areas. All this means that equipments must be simple, positive in action, easy to maintain and readily capable of being correlated with one another. Fuses must be capable of correlation with one another and with the breakers. Customers' fuses must correlate with those of the utility and vice-versa. Intricate, exposed mechanisms must be perfected for durability and freedom from troubles as well as for discriminating action. In many rural cases there seems also to be justification for automatic apparatus that will report the lockout of a remote line section back to some supervisory center. In urban sections there could be thought given to combining the function of isolating a faulted section with the function of temporary no-voltage lockout of the same section so as to permit progressive resumption of service after any prolonged interruption of a more embracive area.

In brief, sectionalization can be a handmaiden of good service continuity insofar as it proves cheaper to install and administer than to build the whole system more resistant to all the accidents that befall. It certainly contributes to the overall reliability by letting healthy areas keep on functioning while only small areas are detached until the trouble clears itself automatically or can be cleared by the crews.

### Index Available

**Because of paper shortage, ELECTRICAL WORLD'S semi-annual index, which ordinarily would be included in the last issue in June, is being printed separately and will be available shortly. It may be obtained by subscribers without charge on request. Address Editor, ELECTRICAL WORLD, 330 West 42nd Street, New York 18, New York.**

## WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

# Fight for Control of Upper Missouri

POST-WAR PLANNING is an old-story in Washington these days. While much of it is concerned primarily with the immediate post-war period and industrial reconversion, considerable long-range planning of river development has been done.

Of interest to the electric power industry is the scope of proposals for federal power installations and the matter-of-fact attitude expressed with regard to them. There has been considerable controversy over the aims, methods and results of the various river development plans. But there is no question about power installations.

### *Two Plans*

Best example of this, perhaps, is the current controversy between the irrigationists and navigationists for control of the Upper Missouri River Basin. This vast region, embracing parts of nine states, has not heretofore been noted for the industrial development which is commonly thought of when huge power generating capacity is discussed. Yet under either of the two plans for its river development which are now before Congress, the region stands to get tremendous amounts of generating capacity. These facilities, of course, would be installed as the load develops, over quite a few years.

There is the "Pick" plan, pride of the Army Engineers who are not at all concerned with the possibilities inherent in control of a huge amount of electric power. It proposes the installation of about 1,000,000-kw. of hydro capacity on the main stem of the Missouri River over many years, and includes numerous secondary sites which could be developed thereafter. The Engineers are "navigationists."

Opposing the "Pick" plan is the "Sloan" plan of the Interior Department's Reclamation Bureau, which calls for ultimate installation of about 1,150,000-kw. of hydro capacity, of which about 750,000-kw. would be firm power. And whereas the Engineers have no desire to control the marketing of the "Pick" plan's power, Reclamation has definite ideas about disposal of the "Sloan" plan energy, and includes in its program plans for a broad network of transmission lines. These would tie the Reclamation hydro plants to almost every local plant in the region.

An indication of the magnitude of the Reclamation program may be gained from its figures on present and proposed installations in Montana. Capacity there today, the Bureau reports, is 373,419-kw., most of it privately owned. Under the Sloan plan, this would be increased by 447,000-kw. of hydro capacity, most of it firm. The "Pick" plan, with all but one of its plants on the main stem of the Missouri River rather than well back on the tributaries, is not susceptible to such comparison with existing systems, but its overall total of power is only 150,000-kw. smaller than the total called for by the Reclamation plan. The Engineers apparently prefer to get a lot of power from a few plants rather than smaller blocks of power from many plants.

### *Enough Water for All*

Despite the extent to which the irrigationist-navigationist fight over which water use shall predominate has spread, both in and out of Congress, there is reason to believe that perhaps no real issue exists. For one thing, state engineers of Nebraska, Colorado, Iowa, Kansas, Missouri, Montana, North Dakota, South Dakota and Wyoming, all the states affected by Missouri Planning, agreed recently after studying the best available reports that there is water enough in the stream for all irrigation projects, existing or proposed by the Reclamation Bureau, for all sanitary needs as asserted by the U. S. Public Health Service and to fill the nine-foot navigation channel from Sioux City, Iowa, to the confluence of the Missouri and Mississippi Rivers above St. Louis. This channel is the principal interest of the Engineers in the Missouri River.

At least some of the Engineer officers who have testified before Congressional committees on the matter feel essentially the same way. Maj. Gen. Eugene Reybold, Chief of Engineers, agreed that developments of tributaries should be under the jurisdiction of the agency with the dominant interest, which is a bald concession to the irrigationist, or Interior, planners. The Engineers insist only that the main stem dams be under their control because of their effect on flood control and navigation.

### *Proposed Dams*

Presently proposed by the Engineers are the Gavins Point plant above Yankton, S.D., with 11,000-kw.; Fort Randall, near the Nebraska-South Dakota line, with 240,000-kw.; Oahe, near Pierre, S.D., with 198,000-kw.; Oak Creek, near Mobridge, S.D., with 222,000-kw., and Garrison, near Staunton, N.D., with 300,000-kw. Osceola, on the Osage River near Osceola, Mo., already has been authorized. Its power has not been determined.

Reclamation's power program is considerably more widespread. It includes these plants: Kortes, 30,000-kw.; Boysen, 10,000-kw.; Kane, 30,000-kw.; Hunter Mountain, 12,000-kw.; Thief Creek, 60,000-kw.; Sunlight Creek, 20,000-kw.; Bald Ridge, 30,000-kw., of Tounge River, 25,000-kw., of which 22,000-kw. would be for seasonal operation only in Wyoming; Yellowtail, with 75,000-kw.; Mission, 50,000-kw.; Canyon Ferry, 35,000-kw.; Portage, 20,000-kw.; Lyon, 23,500-kw.; and another 93,500-kw. for seasonal operation only at Fort Peck's existing 35,000-kw. in Montana; Oahe and Fort Randall with 150,000 and 100,000-kw. respectively, the Miller project, with 141,500-kw. for seasonal operation only and Big Bend with 75,000-kw., in South Dakota, and Crosby and Des Lacs projects, each for seasonal operation only, with 71,600 and 66,667-kw. respectively, in North Dakota.

# NEWS OF THE WEEK

# McKellar Amendments Out; REA Loan Funds Fixed

***Independent Offices bill at White House—Compromise sets REA loan Fund at $25,000,000 — Hearings on Flood Control bill ended — Pace bill in conference***

Congress disposed of one of its major problems last week when it junked the McKellar amendments to the Independent Offices Appropriation bill which would have reduced the autonomy of the Tennessee Valley Authority over its personnel and finances.

The bill was at the White House early this week containing a substitute amendment which would require TVA to report its receipts and expenditures to the Appropriations committee every four months. The disputed McKellar amendments would have given TVA a flat appropriation and required it to turn all revenues into the Treasury, and would also have required Senate confirmation of all employes earning $4,500 or more yearly.

### *Compromise Effected*

The first conference report on the Interior Appropriation bill was filed in the House. It indicated that the numerous differences between the two Houses on the funds which should be made available for Interior activities probably will be compromised without too great difficulty, particularly in view of the drive to clean up appropriation bills in time for a recess at the end of this week.

Conferees compromised the request of the Bonneville Power Administration for $254,000 with which to carry on post-war load development work by splitting the difference. Amendments affecting Bureau of Reclamation projects were largely compromised either by splitting the difference between Senate and House recommendations or by the "you-take-one-I'll-take-one" method. One proposed agreement largely wiped out the House provision which had taken from the Bureau unexpended balances out of which transmission lines could be built. In passing the bill, the House had allocated to other uses an unexpended balance out of which the Shasta-Oroville line had been built, thus cutting off the chance of further unapproved construction.

**"COME AND GET ME!"—Challenged Bre'er Coon from his perch on the crossarm of a pole in Binghamton, N. Y. recently. The challenge was met by Henry J. Kennedy, veteran "trouble shooter" for the New York State Electric & Gas Corp. When the lasso failed, the lineman donned rubber gloves and with a bag shown on the secondary lines, chased the animal away from the street lighting line. The Coon scampered down the pole, flipping its tail high, and escaped into the night**

The Agriculture Appropriation bill was still to be dealt with finally early this week, but its main point of interest to the power industry—the appropriation for loan funds for the Rural Electrification Administration — had been settled by a compromise setting the sum at $25,000,000. Chairman Clarence Cannon, Missouri Democrat, told the House that he was "sure" that if the material situation improved sufficiently to require more loan funds for REA, a deficiency appropriation would be approved. Rep. John E. Rankin, Mississippi Democrat, told the House that REA has $100,000,000 worth of applications pending.

### *Hearings Ended*

Hearings before the Senate Commerce sub-committee studying the $810,000,000 Flood Control bill were ended last week and the committee went into executive session to prepare its report. Before the committee were proposals that Interior Secretary Ickes be given marketing jurisdiction over all power in the bill, as insisted upon by the President for both the Rivers and Harbors and Floor Control bills; that the committee withhold action on the Flood Control bill until the Army Engineers and the Reclamation Bureau agree on a plan for development of the Upper Missouri River; that the Army Engineers be required to consider objections by local interests in making reports on proposed water control or use projects, and that hearings be adjourned until September to give the Engineers and the Reclamation Bureau the opportunity to agree on an Upper Missouri plan.

The Pace bill, extending the life of REA indefinitely, remained in conference, without dispute on its provisions affecting REA.

# Treasury Will Not Oppose Utility Rate Reductions

***Secretary Morgenthau says rate cuts will not be fought to protect revenues—State commissions responsible for establishment of reasonable rates, he states***

The Treasury Department, whose excess profit tax returns have been increasingly imperiled by a trend toward rate reductions or refunds ordered on the basis of war-swollen tax returns, does not intend to oppose reductions solely to protect its revenue, Secretary Morgenthau made clear this week.

Morgenthau's statement followed a series of stories predicting that the Treasury would move to halt the inroads on its excess profits returns which began in real earnest with the Detroit Edison Case, brought by the city of Detroit.

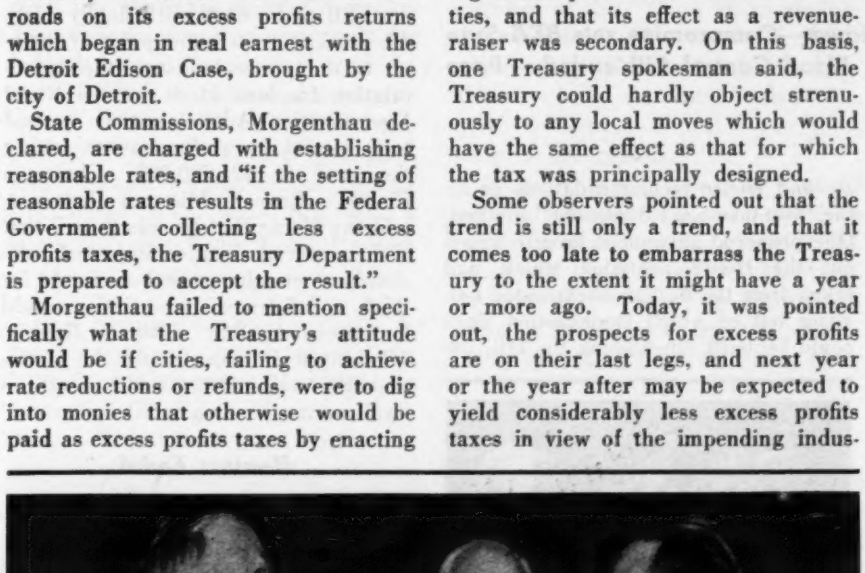
State Commissions, Morgenthau declared, are charged with establishing reasonable rates, and "if the setting of reasonable rates results in the Federal Government collecting less excess profits taxes, the Treasury Department is prepared to accept the result."

Morgenthau failed to mention specifically what the Treasury's attitude would be if cities, failing to achieve rate reductions or refunds, were to dig into monies that otherwise would be paid as excess profits taxes by enacting local franchise taxes, as was done by the city of Detroit. A spokesman for the Internal Revenue Bureau, however, said the Treasury's attitude in such event would undoubtedly remain the same.

It was pointed out that the excess profits tax, even though it actually is a first-class revenue-raiser, was instituted with the primary idea of preventing undue profits from wartime activities, and that its effect as a revenue-raiser was secondary. On this basis, one Treasury spokesman said, the Treasury could hardly object strenuously to any local moves which would have the same effect as that for which the tax was principally designed.

Some observers pointed out that the trend is still only a trend, and that it comes too late to embarrass the Treasury to the extent it might have a year or more ago. Today, it was pointed out, the prospects for excess profits are on their last legs, and next year or the year after may be expected to yield considerably less excess profits taxes in view of the impending industrial cutbacks. The Treasury has already collected excess profits taxes for 1941, 1942 and 1943. It is believed to doubt that the movement to siphon off these taxes will become sufficiently widespread this year to cause any great embarrassment, and even if it does, the Treasury will still have collected during the lush years of the war program.

Morgenthau's statement substantiates the position taken by Counsel Thurman Hill of Treasury's Procurement Division, who, joining with the Office of Price Administration in an attack on the rate structure of the Potomac Electric Power Co. more than a year ago, argued that rate reductions, even though they imperil Federal revenues, would help OPA carry out its task of holding down the cost of living.



**POST-WAR LIGHTING DEMONSTRATION—The Minister of Reconstruction, Lord Woolton, was guest of honor at the Electric Lamp Manufacturers meeting held recently at the Savoy Hotel, London, England. The accompanying illustration shows Lord Portal being greeted by the chairman; Lord Woolton in back**

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## Seek Further Delay on Hetch Hetchy Ban

Seeking to avert a $2,400,000 possible loss of revenue, the City of San Francisco is renewing a plea to delay enforcement of a Federal Court injunction which would prohibit the sale of Hetch Hetchy electrical energy to a private corporation (Pacific Gas & Electric Co.) for re-sale to consumers.

At present the city's Hetch Hetchy power is sold exclusively to a war emergency aluminum plant at Riverbank, outside of San Francisco, Calif. However, the plant's contract may be canceled at any time as the stock piles of aluminum increase, and the city would be left with no power customer.

Asking for an extension of the suspension of the injunction, the city attorney revealed engineers were considering using the power to operate San Francisco's combined street railway systems. This would require either construction by the city of a transmission line into the city or lease of such facilities from the P. G. & E., both alternatives termed "high in cost".

Total city demands for electrical energy, including street lighting, would consume but 50 to 60 percent of Hetch Hetchy's generating capacity. Curtailed operations would result in decreased revenue from the $100,000,000 hydro-electric and water system.

When the project was completed, with construction of transmission lines ending outside the city, San Francisco made a contract for sale of the power to the P. G. & E. Federal Judge Michael J. Roche subsequently ruled the contract was in violation of the Raker Act, a decision upheld by the United States Supreme Court.

# REA Dismissals Bring Hunger Strike Threat

***Ousted employee writes the President complaining of politics in agency—Agriculture Department representative defends dismissals as economy move and effort to save manpower***

Dismissal of at least three aides to Rural Electrification Administrator Harry Slattery brought from one of the ousted employees this week a threat to engage in a hunger strike until the President or the Congress "frees the REA program for the farmers of America."

Chester Lake, an employee of REA since its organization nine years ago and now field representative for Slattery, wrote the President complaining of politics in the agency which Congress decreed should be totally nonpartisan and told of his intention "to eat no more" after June 28 when he completes a series of luncheon addresses. Lake told the President he was prepared to sacrifice his life on the home front for democratic principles as other men are sacrificing on foreign shores.

It was learned that Lake was one of three and possibly four of Slattery's immediate aides who was ousted. Others are Angus Burns, a special assistant to Slattery, and Dr. Jack Levin, another nine-year veteran of REA, an attorney and consultant. It was not clear whether Judson King, also a consultant and a long-time public power crusader whose articles on the National Rural Electric Cooperative Association last summer brought to a head the controversy raging between REA factions, was ousted. King had not been notified early this week of his dismissal, but his name was understood to be on the list.

An Agriculture Department spokesman said "less than half a dozen" jobs were abolished, and declared that the move was not confined solely to REA but took in other divisions of the Department as well. Those jobs which it deemed could be done away with were abolished as an economy move and to save manpower, the Agriculture Department spokesman said.

Rumors of widespread changes in the Operations Division, where Slattery musters stronger support than he does in certain other divisions of REA, were denied by the spokesman.

Administrator Slattery told ELECTRICAL WORLD he had not been informed of the changes, but that they had been ordered in a letter from Agriculture Secretary Claude R. Wickard to REA Deputy Administrator William J. Neal, whom Wickard installed a year ago in a move which has almost completely by-passed Slattery.

It was understood that in addition to abolishing several jobs, a new "Utilization Section" had been established to replace the Utilization Division which was junked as contrary to agriculture policy soon after REA was taken over five years ago. The Personnel Division was also revamped in Wickard's June 12 letter to Neal, it was understood.

It was also understood that both Levin and Slattery had protested the abolishment of Levin's job and asked a review by the Civil Service Commission. While there was no confirmation from the Commission, it was understood that a review board will be organized to hear Levin's case.

The Agriculture Department spokesman said abolishment of jobs was a normal administrative procedure and did not prejudice those whose jobs were junked in attempting to obtain reemployment. Slattery's supporters, however, insisted that in previous such moves, those whose jobs were abolished never continued with REA.

## Safety Contest Takes A Pacific Cruise

The month of May saw an accident-free record chalked up for all departments of the Wisconsin Public Service Corp., this being the first month of their "Supply Line Safety Contest" competition. This competition will take all employes of WPSC from their home in the Great Lakes territory to Calcutta, India by way of routes marked out on a large map of the Pacific Ocean posted on all safety bulletin boards.

Ships representing the power system, Valley division, Menominee-Marinette division, Sheyboygan-Manitowoc division, Green Bay division and Oshkosh division had reached the Mid Pacific at the end of the first month of the three months' outbound voyage. The ships move approximately 500 miles a week, the safety progress being reported by weekly communiques signed by the commanding officers of each vessel. Departmental organizations also developed along ship lines in turn furnish the ship commanders with important information.

Principals in guiding the contest to its successful goal are J. P. Pulliam, WPSC president and Naval Chiefs of Operations of the contest, and his principal assistant, Safety Commander C. H. Hansen.

**SUPPLY LINE SAFETY CONTEST**—Enthusiastic employees of the Wisconsin Public Service Corp. set up in their main office a chalked up map showing their progress made in the contest now being conducted. Their 18,000 ton transport vessel is accompanied with a complete naval convoy fleet

# After-the-war Promotion Is Now Being Planned

***Association to guide electrical merchandizing — Local utility may not engage in merchandizing, but promote services instead — New equipment to be given prominence***

Some of the plans for the after-the-war promotion by electrical manufacturers, wholesalers and utilities in the Pacific Northwest were disclosed at a series of regional meetings for electrical dealers and contractors opening in Mt. Vernon, Wash., June 5. The meetings, which are sponsored by the utilization section of the Northwest Electric Light & Power Association, and chairmaned by C. E. Hess, Puget Sound Power & Light Co. who is section chairman, were the first meetings of this kind ever undertaken by the association. The Mt. Vernon gathering attracted 104 registrations, 55 of whom were dealers and contractors from 15 cities and towns of Western Washington from Bellingham to Everett, the others being utility, manufacturer and jobber representatives.

Mr. Hess, who covered that part of the program devoted to utility plans for working with dealers and contractors, stated that if it was found to be economically possible, the company would not engage in merchandising of appliances anywhere in the territory but would leave this function solely to dealers. The company would, however, engage in promotional activities involving home service, promotion of adequate wiring among all elements of the building industry, lighting promotion in all fields, promotion of farm uses and expansion of the company's experimental laboratory for testing new applications.

D. B. Leonard, Pacific Power & Light Co., represented the manufacturers and distributors on the program, displaying advertising, pamphlets and other literature that are now being made available to retailers to help them plan their business for the post-war era. The national adequate wiring program for the building industry was presented by Arthur E. Schanuel of the Adequate Wiring Bureau, New York.

The work of the association and the manner in which a united industry front could be made effective in joint promotions of electrical devices that will be sure to come were brought out by Ross B. McElroy of the Washington Water Power Co. Under the title "When the Shooting is Over," George W. Allison, formerly with E.E.I., now with the Puget Sound Power & Light Co., closed the meeting with an inspirational address pointing out the many profitable opportunities for all branches of the industry if they would but plan in advance to get actively into the business as soon as the door would be opened after V-day.

Interspersed between these talks were demonstrations of new, and comparatively new, equipment that would find increased use in the country's peace-time economy, by Berkeley Snow, executive secretary of the association. New long tube and thin tube fluorescents, now being tested in the General Electric laboratories, were displayed through the use of wooden models. Circular fluorescents, likewise still in the laboratories of the lamp manufacturers, were shown in the same medium. The Westinghouse Precipitron for cleaning dust particles from air was demonstrated, as was polaroid light and black light. In addition, the first public showing anywhere of a new application of Du Pont's silver base paint, used for a heating element on an interior surface, as developed in the Puget Sound Power & Light Co. experimental laboratory by C. W. Wildebour, was also shown and demonstrated.

The Seattle meeting, the second of the series, had over 200 registrations. Other towns covered in this first series of regional dealer meetings, which ran through June 16, were Olympia, Wenatchee, Okanogan, Spokane, Walla Walla, Yakima, Wash.; Lewiston, Idaho; and The Dalles, Oregon.

**A COMPOSITE GROUP—Representing the gamut of the electrical industry in the Northwest are shown members at one of their meetings to discuss plans for promoting electrical equipment after the war. C. E. Hess, utilization manager, devoted part of the program to utility plans; D. B. Leonard, Pacific Power & Light Co., represented the manufacturers and distributors on the program**

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## WPB Relaxes Irons Curb To Meet 2,000,000 Quota

WPB has authorized the manufacture of an additional 201,000 electric irons, and need authorize only another 240,662 to meet its program for 2,000,000 such irons this year.

Chicago Flexible Shaft Co., with 162,500, and Sampson United Corp., Rochester, with 38,500, are the latest manufacturers to be approved.

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## April Energy Output

Electric energy produced for public use in April, 1944, totaled 18,351,703,000 kw.-hr., an increase of 8.2 percent over production in April, 1943, according to a report issued by the Federal Power Commission. Average daily

production of electric energy for public use in April was 664,917,000 kw.-hr.

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## Public Service Cuts Rates $5,000,000

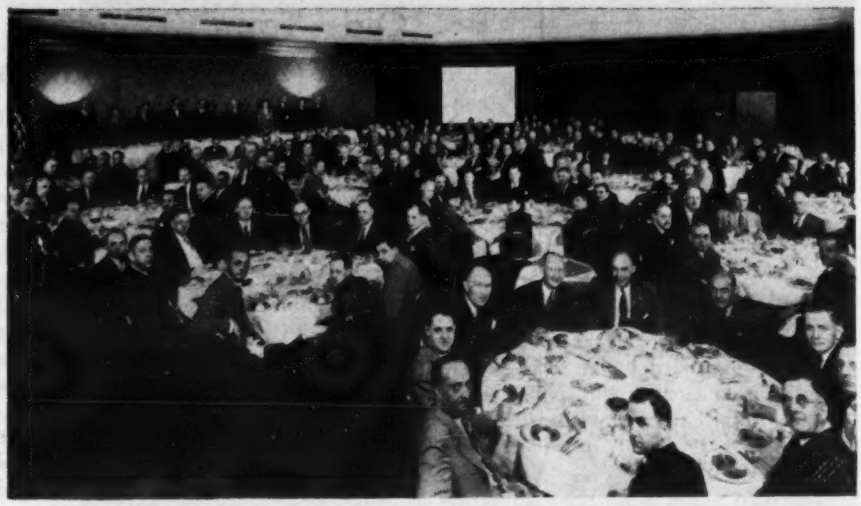
The state Board of Public Utility Commissioners, voting 2 to 1, approved a lower schedule of electric rates of the Public Service Electric & Gas Co., designed, the majority statement said, to save customers of the state's largest utility $5,000,000 a year. The decrease becomes effective on July 1.

In a dissenting opinion Commissioner Crawford Jamieson, of Trenton, said the company could afford to slash its rates $9,000,000 a year and still make 6.4 per cent on its investment this year, and declared the decrease would be of no benefit at all to 130,000 small household users of electricity, and of little benefit to most other residential customers.

The majority opinion, concurred in by Commissioner Joseph E. Conlon, president of the board, of South Orange, and Commissioner John E. Boswell, of Ocean City, characterized the decrease as "the largest single reduction ever effected through negotiations between the board and the company," and pointed out the agreement of the board and company eliminated the need for a lengthy rate proceeding.

Announcement of the reduction was followed by a statement from Thomas N. McCarter, chairman of the board of the Public Service Corp. of N. J., and also chairman of the Public Service Electric & Gas Co. The statement, to shareholders, said the company agreed to accept the reduction, although not approving it, "and believes it could only be sustained, if at all, through the adoption by the board (of Public Utility Commissioners) of new-fangled theories of rate making which have never been adopted by any New Jersey Commission since 1911, when the rate-making power was conferred . . . The company believes the imposition of such doctrine to be unfair to investors, unjust and inequitable, especially in such an awful time of war and stress. Nevertheless, to avoid the complication of a long rate case the company has agreed to accept this demand of the board."

The reduction will be distributed to classes of consumers as follows: Residential, $1,823,500; commercial light and power, $1,462,500; general service, $791,100; retail power, $100,000; retail power and general service, $338,500; refrigeration and general service, $140,000; commercial light and power and general service, $375,000.



**LOOKING AHEAD—A representative group of Clevelanders gathered to discuss methods for meeting post-war demands for electrical equipment. Speakers were Irvin W. Clark, manager of the Better Homes department of Westinghouse Electric & Manufacturing Co., and Miss Myrtle Fahsbender, director of residential lighting for Westinghouse**

## Third Post-war Planning Meet Held In Cleveland

Bankers, architects and builders joined with members of the Electrical League of Cleveland for the league's third post-war planning conference. In two sessions, some 200 delegates heard papers on developments in residential wiring and lighting and took part in discussions on financing electric equipment in the same mortgage loan which covers the home.

The series of meetings has sought to develop methods for meeting the demand for $23,000,000 worth of electrical equipment which it is estimated that Greater Cleveland will require in the first five years after the war.

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## Niagara Diversion Ruling Amended

Federal Power Commission has authorized amendment of license for Project No. 16 of the Niagara Falls Power Co., Niagara Falls, N. Y., which will permit the company to place in effect as of January 1, 1943, the rate of about 2.78 mills per kilowatt-hour prescribed by the state Public Service Commission.

At the time of authorizing the use of the water (5,000 cfs. and later 7,500 cfs.), FPC required the company to account for the sale of power developed therefrom at the rate of 4 mills per kilowatt-hour. This revenue, less expenses, was to be set up in a reserve fund, the difference between the rate collected and the cost of supplying the power to apply to the government's recapture price of the Niagara Falls Co. if the government should elect to take over the property at the expiration of the company's federal license in 1971.

On November 11, 1942, the state commission ordered the company to reduce the rates for this emergency power to approximately 2.78 mills per kilowatt-hour. The Niagara Falls Power Co. petitioned both the FPC and the PSC, asserting that it "could not obey both orders without losing a great deal of money, as the difference between the rate fixed by the PSC and the rate ordered by the FPC would mean a loss of about $1,000,000 annually."

As a result of the most recent action, war industries in the Niagara Falls area using this special emergency power will receive a refund representing the difference between these two rates, and from now on will be billed at the PSC rate.

The Niagara Falls Power Co. will continue to develop this emergency power for the duration at no profit to the company, as maintained under the original terms of the grant.

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## "Flash-over" Cuts Service

A "flash-over" in the main 4,000-volt switchboard at the P.U.D. Electric park warehouse caused a short circuit in the entire distribution system today which blacked out all of Grays Harbor. P.U.D. Manager Kelly Westrom said that although damage was light, veteran troublemen of the P.U.D. remained on the job throughout the night repairing damage and endeavoring to

ascertain the cause. Emergency lines were run by linemen to provide temporary service, all power being supplied by Bonneville and the two substations.

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## Simplification Plan Filed with SEC

Washington Railway & Electric Co. has filed with the Securities and Exchange Commission a plan of corporate simplification to meet the requirements of the Public Utility Holding Company Act, Alfred G. Neal, president, has announced.

The plan provides for the elimination of Washington Railway & Electric Co., whose stock will be exchanged for stock of Potomac Electric Power Co., and Capital Transit Co. The Washington and Rockville Railway Co. of Montgomery County, a subsidiary, will also be dissolved.

The plan must be approved and found by the Securities and Exchange Commission to be fair and equitable to all security holders and in the public interest. Also, certain essential steps proposed under the plan require approval of the Public Utilities Commission of the District of Columbia. Because of the necessity of these and other legal proceedings, Mr. Neal pointed out, no forecast can be made at this time as to when the plan may become effective.

In 1942, the Securities and Exchange Commission, pursuant to Section 11 of the Holding Company Act, directed the Washington Railway & Electric Co. and the Washington & Rockville Railway Co. of Montgomery County to divest themselves of their interests in certain subsidiaries. Mr. Neal stated that the company's directors believe the plan submitted meets the objectives of the Holding Company Act and is fair and equitable to preferred and common stockholders.

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## WPB Sanctions New Line

Interstate Power Co., Dubuque, Iowa, recently received WPB authorization to construct a 16½-mile 69-kv. wood pole transmission line and 2,000 kva. terminal substation between points on its system in northern Iowa and southern Minnesota. While the line will be constructed for eventual 69 kv. operation it will be energized initially at 33 kv. Single pole line structures and ACSR conductors are to be used, it was stated by company spokesmen in Dubuque recently.

## Olds' Term Expires; No Senate Action

Leland Olds' term as a member of the Federal Power Commission expired June 22 without action on his re-appointment by the Senate. Under the Federal Power Act, Vice-Chairman Basil Manly automatically became acting chairman.

The Senate early this week appointed a five-man subcommittee to consider Olds' re-appointment. It scheduled a hearing for July 6, when the Congress was to be in recess. Olds' re-appointment was submitted to Congress by the President May 25. He was appointed to the commission in June, 1939, and elected chairman soon thereafter.

Members of the sub-committee to consider the Olds' appointment are Sen. Robert Wagner, New York Democrat, chairman; Sen. James M. Tunnell, Delaware Democrat; Sen. Edwin C. Johnson, Colorado Democrat; Sen. E. H. Moore, Oklahoma Republican, and Sen. Albert W. Hawkes, New Jersey Republican.

Little doubt is heard that the committee will recommend Olds' confirmation at the conclusion of its hearings. The hold-up was generally regarded in informed quarters as instigated by political considerations. Olds had been berated a year ago by Sen. Styles Bridges, New Hampshire Republican, who charged his appointment had been a political payoff to the American Labor Party in New York State, where it had helped the administration weather several close political battles. Olds, Bridges charged, wrote extensively for the Communist Daily Worker during the 1920's and before his affiliation with the Power Authority of the State of New York, which he served as executive secretary from 1931 to 1939.

Olds told ELECTRICAL WORLD that he had no plans beyond "getting a good rest" after the expiration of his term.

## MEETINGS

**Previously Listed**

**American Society for Testing Materials**—Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., June 26-30. Robert J. Painter, assistant secretary, 260 S. Broad St., Philadelphia 2, Pa.

**American Institute of Electrical Engineers** — National technical meeting, Jefferson Hotel, St. Louis, Mo., June 26-30. Pacific Coast technical meeting, Biltmore Hotel, Los Angeles, Calif., August 29-September 1. H. H. Henline, national secretary, 33 W. 39th St., New York 18, N. Y.

**International Association of Electrical Inspectors**—Northwestern section, Olympian Hotel, Olympia, Wash., August 21-23; E. B. Morrison, secretary, P.O. Box 70, Portland, Ore. Southwestern section, Modesto Hotel, Modesto, Calif., August 28-30; H. L. Gerber, secretary, Room 205, City Hall, San Francisco, Calif. Western section, Claypool Hotel, Indianapolis, Ind., September 11-13; F. H. Moore, secretary, 320 N. Meridian St., Indianapolis, Ind. Eastern section, DeWitt Clinton Hotel, Albany, N. Y., September 18-20; F. N. M. Squires, secretary, 85 John St., New York, N. Y. Southern section, Ainsley Hotel, Atlanta, Ga., September 25-27; A. M. Miller, secretary, 219 Governor St., Richmond 19, Va.

## Priority System Will Be Set Up by WMC

A national committee to determine manpower priorities, particularly with respect to the transfer of workers from one region to another, was to be organized shortly, possibly this week, by War Manpower Commission.

The new committee, to include representatives of WMC, Army, Navy, Maritime Commission, Aircraft Resources Control Office, Selective Service and WPB, will determine essentiality of employers on a national basis for the use of local United States Employment Service offices in directing workers to jobs under the nation-wide "priority referral" system which takes effect for all male workers on July 1.

USES offices not only will be called upon to fill the most urgent manpower requirements locally but also to export workers from areas where a surplus of labor exists to labor shortage areas on a quota basis.

Local manpower priorities committees in WMC's Group I and II labor areas, (areas of acute shortage and shortage respectively) are to be organized under the "priority referral" plan.

Workers will be referred first to jobs in urgent war production programs such as high-octane gasoline, rubber, landing craft, secret weapons and the like. Then they will be referred to all other war production, and finally to essential civilian production.

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## NEMA Standards Adopted By Northwest Group

The Northwest Electric Light and Power Association's Committee on Water Heater Standardization unanimously accepted a motion that NEMA water heater standards be adopted and agreed to discuss with the respective managements and department heads the possibility of having changes made in rates, regulations and practices to give effect to such standards.

The Northwest water heater committee which includes twelve major utilities on its staff has been organized and functioning but a short time, with J. F. McAllister, Utah Power & Light Co., as chairman.

## Output Curve Again Moves Upward

The output curve moved upward again during the week ended June 17, 1944, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry during the week came to a total of 4,287,251,000 kw.-hr., as compared to the figure of 4,264,600,000 kw.-hr. for the week previous, which ended on June 10. Figures for the week represented an increase of 4.6 percent over the 4,098,401,000 kw.-hr. distributed during the corresponding week a year ago. The output for the similar week two years ago was lower, the total being 3,433,711,000 kw.-hr.

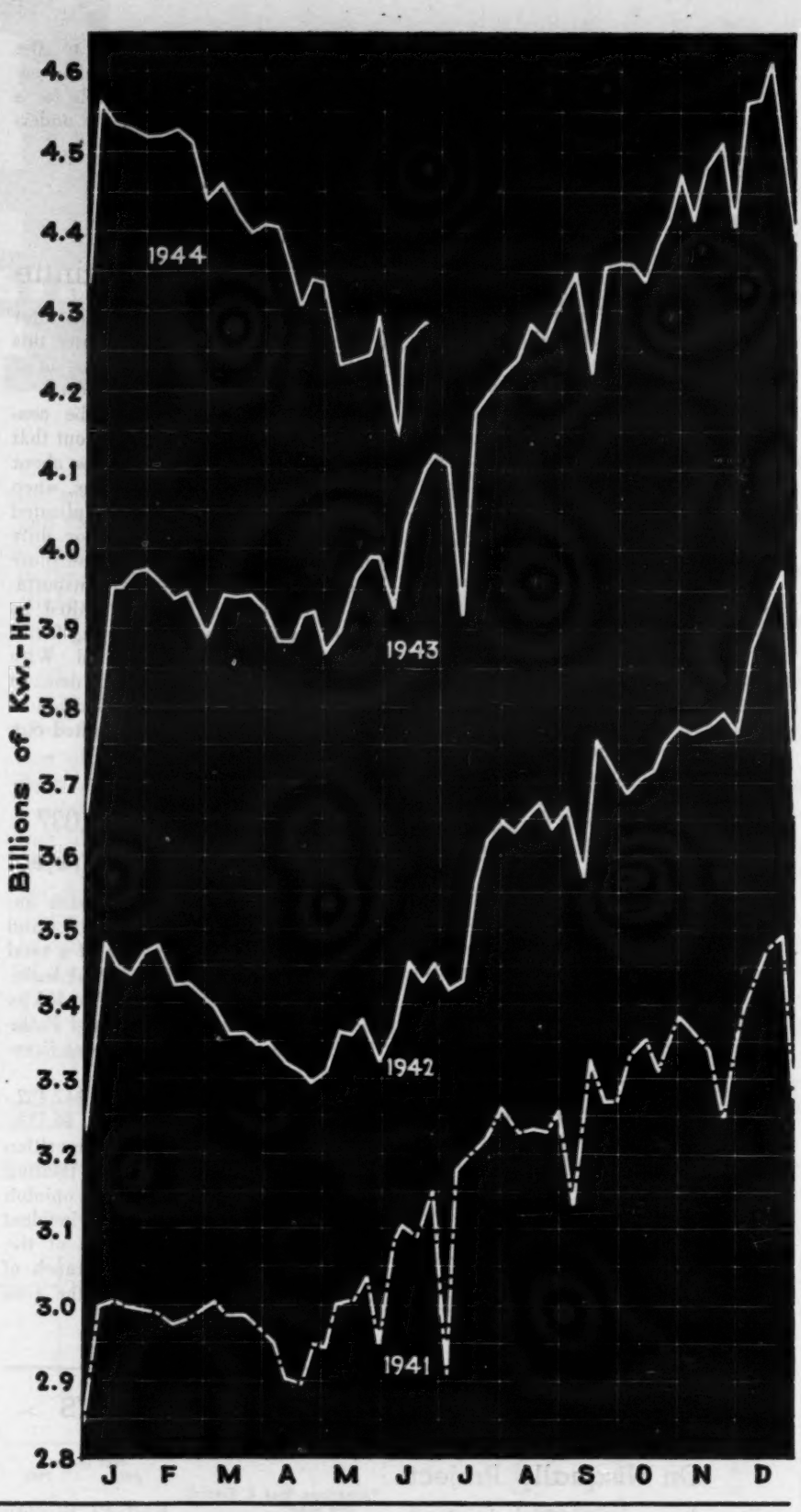
Five of the seven major geographic regions of the country reported increases for the week over the corresponding week last year, the Pacific Coast states leading with a gain of 16.5 percent and the Southern states ran second with an increase of 6.3 percent. Central Industrial ran third with an increase of 4.8 percent. The Rocky Mountain region reported a decrease of 8.5 percent as compared with a loss of only 3.6 percent for the week ended June 10.

**Weekly Output Millions Kw.-Hr.**

| 1944 | | 1943 | | 1942 | |
|---|---|---|---|---|---|
| June 17 | 4,287 | June 19 | 4,098 | June 20 | 3,434 |
| June 10 | 4,265 | June 12 | 4,040 | June 13 | 3,464 |
| June 3 | 4,144 | June 5 | 3,926 | June 6 | 3,372 |
| May 27 | 4,292 | May 29 | 3,990 | May 30 | 3,323 |
| May 13 | 4,238 | May 15 | 3,969 | May 16 | 3,357 |
| May 6 | 4,234 | May 8 | 3,904 | May 9 | 3,365 |
| Apr. 29 | 4,336 | May 1 | 3,867 | May 2 | 3,305 |
| Apr. 22 | 4,344 | Apr. 24 | 3,925 | Apr. 25 | 3,273 |
| Apr. 15 | 4,307 | Apr. 17 | 3,917 | Apr. 18 | 3,308 |
| Apr. 8 | 4,361 | Apr. 10 | 3,882 | Apr. 11 | 3,321 |
| Apr. 1 | 4,409 | Apr. 3 | 3,890 | Apr. 4 | 3,349 |
| Mar. 25 | 4,409 | Mar. 27 | 3,928 | Mar. 28 | 3,346 |

**Percent Change from Previous Year**

| | Week Ending | | |
|---|---|---|---|
| | June 17 | June 10 | June 3 |
| New England | + 2.7 | + 2.0 | — 1.2 |
| Mid-Atlantic | — 1.2 | — 1.9 | — 0.2 |
| Central Industrial | + 4.8 | + 5.7 | + 4.4 |
| West Central | + 3.9 | + 6.3 | + 5.7 |
| Southern States | + 6.3 | + 8.7 | +10.4 |
| Rocky Mountain | — 8.5 | — 3.6 | —11.2 |
| Pacific Coast | +16.5 | +15.7 | +16.0 |
| Total United States | + 4.6 | + 5.5 | + 5.6 |




## Home Service Program Opened by Iowa Utility

Iowa-Illinois Gas & Electric Co. at Iowa City, Iowa, has just announced an expanded summer program through the addition of a home service department, according to George M. Sheets, sales supervisor. A graduate home economist, Miss Norma L. Pepler, of Iowa City, will be the director of the new home service department.

A city wide nutrition and canning program has also been worked out by the local Civilian Defense Council, of which Miss Pepler will serve as "Master Canner" information bureau for the program.

## Second Unit for Dallas

The Office of War Utilities has approved installation of a second 30,000 kw. steam generator at the Mountain Creek plant of the Dallas Power & Light Co., Dallas, Tex. The unit will go into operation in December, 1945, according to present plans.

## PSC Approves Fuel Clause Principles

In order to give greater uniformity to fuel clauses, employed by utilities throughout the state of Connecticut, the Public Service Commission has approved a set of principles upon which all fuel adjustment clauses shall be based.

The proposed fuel adjustment clause shall be based upon the following principles:

1. The fuel adjustment clause is designed not to increase the company's net revenue, but to recoup increases in the cost of the fuel and at the same time to give to the customers the benefit of any decreases in the cost of fuel that may occur in any subsequent downward trend of price levels.

2. The fuel adjustment clause shall—

(a) provide that the cost of fuel shall be the price per net ton of coal, or its equivalent, delivered alongside of generating stations, including inventory.

(b) provide for the same basis of adjustment when the price of fuel is lower as when said price is higher than the base price.

(c) provide that the basis of adjustment be consistent with the generating and delivery efficiency and shall be changed from time to time as changes in such efficiency justify.

(d) provide, whenever the ends of equity as between company and customer can be served thereby, a neutral zone within which the adjustment will not apply, but when the fuel price rises above or falls below the neutral zone the adjustment shall be applied from the base price.

(e) provide that a downward adjustment, reflecting a decrease in the cost of fuel, shall be mandatory and an upward adjustment, reflecting an increase in the cost of fuel, shall be at the election of the utility. The fuel adjustment clause as filed shall indicate whether such upward adjustment will be applied automatically or only from time to time as the utility may decide.

•

## $17,712,381 Spent to Date On Nisqually Project

Expenditure of $525,976 during April boosted total costs of the second Nisqually power project since construction started to $17,712,381, it was disclosed in a report made recently to the Tacoma, Wash., city council by Chief Engineer J. J. Downey.

Work on the project was reported to be moving at a normal rate following removal of cave-in in the LaGrande tunnel, leading from the dam to the powerhouse. The cave-in, which occurred in March, was responsible for a protracted delay in work on the underground incline.

•

## Northwest Fuel Oil Curbs Continue

Deputy Petroleum Administrator Ralph K. Davies threw cold water this week on hopes of an early relaxation of fuel oil rationing in the Northwest.

Davies said rationing will be continued indefinitely, and pointed out that fuel stocks in the area are now about half those on hand in peace-time, when the supply problem was not complicated by the diversion of tankers for duty with the fleet and to supply off-shore bases. He added that train transportation of oil into the area is limited by lack of facilities and that refining facilities in the area also are limited. With normal transport cut down, demand has soared with the industrialization of the region for war, Davies pointed out.

•

## FPC Disallows $6,133,037 on Utilities Project

The Federal Power Commission announced today its entry of an order and opinion (No. 115) disposing of a total of $54,866,625 claimed as actual legitimate original cost of Project No. 405 by the Susquehanna Power Co. and Philadelphia Electric Power Co., joint licensees, as of December 31, 1932.

The order announced allows $47,432,546, disallows, as project cost, $6,133,037, and reserves for future disposition pending further hearing items totaling $1,301,042. The last sum, the opinion states is a part of the cost incident to the relocation of a portion of the Columbia and Fort Deposit branch of the Pennsylvania Railroad in the area of the project reservoir.

## UTILITY REPORTS

| | Net Income 1944 | 1943 |
|---|---|---|
| *American Gas & Electric and subs. | $11,782,372 | $11,119,597 |
| *Arkansas Power & Light. | 1,232,035 | 1,236,532 |
| *California Elec. Power and subs. | 1,299,649 | 936,234 |
| *Dallas Power & Light... | 1,323,622 | 1,491,803 |
| *Engineers Public Service and subs. | 5,671,217 | 4,641,277 |
| *Louisiana Power & Light | 683,191 | 1,349,996 |
| *Mississippi Power & Light | 528,744 | 795,197 |
| *New Orleans Public Service | 1,617,823 | 2,318,334 |
| *Northwestern Electric.... | 648,862 | 692,554 |
| *Pacific Power & Light..... | 1,114,985 | 1,033,222 |

*Twelve months ended April 30.

## OPA Alters Pricing on Rebuilt Motors

A new formula for pricing reconditioned fractional-horsepower electric motors was announced this week by the Office of Price Administration, to become effective June 26.

The new regulation, which substantially increases ceiling prices for these motors, is designed to bring into the market as many such motors as possible. Heretofore, low ceilings worked against extensive rebuilding of fractional horsepower motors.

The new formula provides for calculating the retail price of motors of ¾ hp. or less as follows: 75 percent of the list price of the nearest equivalent new motor, plus $7, minus a stipulated allowance for any used motor turned in. Trade-in allowances are $1 for motors of ¼ hp. or less, $2 for motors of ½ to ¼ hp. and $3 for motors of ¾ to ½ hp.

Ceiling for rebuilt fractional horsepower motors at other than the retail level are set at 85 percent of the ceiling price determined in accordance with the foregoing formula.

Previously, ceiling prices were set at 85 percent of the ceiling for a comparable new motor. Under this provision, few used motors were rebuilt, and when war programs, particularly aircraft, developed demands for all fractional hp. motors, need for pricing relief which would get used motors back into service became apparent.

•

## Appeal Write-Off Orders

Niagara, Lockport & Ontario Power Co. and the Lockport & Newfane Power & Water Supply Co., Niagara Hudson System, companies, have petitioned the New York Public Service Commission for rehearings with respect to recent orders of the commission, directing the companies to make write-offs from their utility plant accounts. The order, if complied with, would require the write-off of approximately $4,704,045 as of Jan. 1, 1938. The utilities are challenging the orders on the ground that they were based on errors of law and fact.

•

## Resume Dividends

Winnipeg Electric Co. has declared a dividend of $5 on its 5 percent noncumulative preferred stock. This dividend is payable in two instalments of $2.50 each on June 30 and Dec. 30 to stockholders of record on May 15 and Nov. 15, respectively, and marks the first payment since reorganization of the company in 1935.

# HOW

**DESIGN · CONSTRUCT · OPERATE · MAINTAIN**

## Turbo Generator Erection Fundamentals

The first consideration in erecting a modern steam turbine generating unit is to check the foundation in respect to physical dimensions. The exhaust piece is carefully set and packed, and since this forms the key piece for all other settings, it is obvious, according to a paper by R. H. Keen, Engineer-in-charge of Outside Department, the English Electric Co., printed in the company journal, that this must be correctly positioned to obtain true shaft alignment.

Since large castings are subject to distortion and must be properly handled, it is necessary to check cylinders for level and for bore distortion at this early stage.

It is important to pack correctly and firmly the various bedplates and pedestal stools for bearing supports. Care must be taken that, in connecting the condenser to the turbine exhaust and the various pipe services to the castings, undue strain is not produced in the latter which will affect the final alignment and running clearance.

### *Alignment of Shaft*

The important operation of lining out the shaft should proceed easily after having assembled the bottom line of cylinders and bearings. The shaft will retain its own natural deflection at any speed except for variation when passing through a critical speed; and, since this is true, the importance of alignment follows as a natural sequence. The bearings should be lined out to suit the static deflection of the shaft not on a true horizontal axis, since practice and experiment have proven conclusively this to be wrong.

It is not necessary to know the theoretical deflection curve, since, for all practical purposes, true alignment may be obtained by accurate readings taken between the coupling faces and over the coupling periphery as shown by Fig. 1. When equal readings are obtained at 4 points at 90 deg. to each other round the circumference at points X and Y, then the shafts can be taken as being in alignment. This, of course, assumes the coupling faces and periphery to be true with the journals.

The readings from which the curve in Fig. 2 were obtained are given in Table I. When corrections were made, true alignment was again restored, demonstrating the accuracy of the measured readings. It is of importance that no error greater than 0.001 of an inch be made in this process.

It has been found that alignment of the unit in service has been affected from the original settings by foundation settlement, distortion of cylinders, etc. and it is essential to check

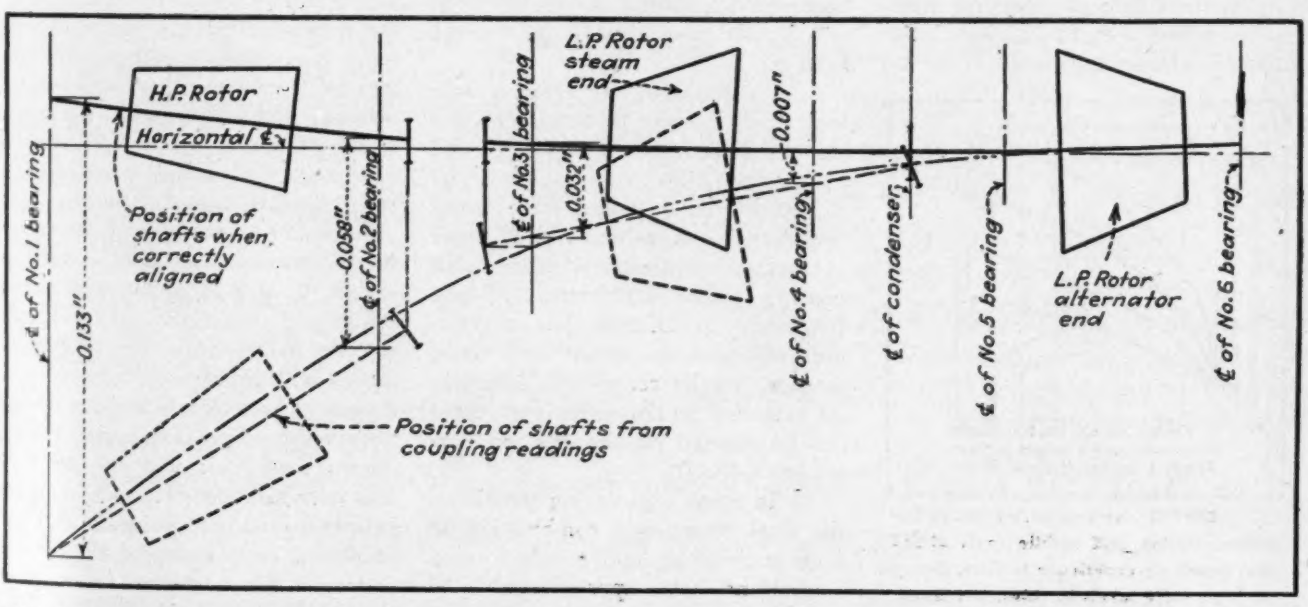



FIG. 2—Diagrammatic representation of (exaggerated) out-of-alignment as measured on a 30,000 kw. turbo alternator

**Table I. Measurements in inches and indicated relative differences**

| Coupling | Top | R. H. | L. H. | Bott. | Coupling |
|---|---|---|---|---|---|
| Gap reading x as Fig. 1..... | .0045 | .000 | .0025 | —.002 | HP to LP |
| Periphery reading y as Fig. 1.... | .006 | .026 | .021 | .041 | HP to LP |
| Gap reading x as Fig. 1..... | .010 | .006 | .006 | .002 | LP to LP |
| Periphery reading y as Fig. 1.... | .008 | .006 | .013 | .011 | LP to LP |

alignment during periodical overhauls.

Clearances for blades and other rotating parts of the turbine are important since the operating characteristics may well be changed by this spacing. The shaft alignment and blade clearance are interrelated problems, since the shaft must be set central in the cylinders and at the same time in true alignment. The reliability of the unit and its economy of steam consumption are dependent upon the following of the designer's clearance figures. Care must also be exercised in dealing with shaft glands, interstage glands or balancing dummies; and, if properly measured by feeler gauges, no trouble should be encountered.

In grouting, the mixture employed, the bonding to the main foundation block and the filling of the inside portions of stock and bedplates were necessary and important points to note.

The rotor is carefully dynamically balanced before leaving the manufacturer, but it should be checked in the field by an experienced balancer since occasionally some slight adjustment is necessary.

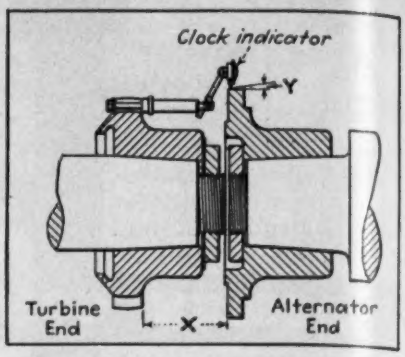



**FIG. 1—General arrangement of apparatus for measuring alignment**

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## Mobile FM Costs and Limits

In the installation of a new two-way radio communication system the basic problems are readily evident to the engineer involved, but the solutions thereof are not so evident. He knows the location of the dispatcher who should be in control of the system; also, quite accurately the location of the mobile unit which will be the most difficult to reach by radio from headquarters. This may be either the most distant unit or the unit with the most unfavorable intervening ground elevations, was stated by D. Lee Chesnut, Electronics Department of General Electric Co., recently in a paper before the Southeastern Electric Exchange.

Important data necessary to determine whether a 60 or 250 watt headquarters transmitter and 30 or 60 watt mobile transmitter are necessary follow:

1. Mileage from dispatcher to mobile unit.
2. Ground elevation at dispatcher's location.
3. Height of dispatcher's building or suitable building for antenna.
4. General contour of intervening terrain.
5. Effective ground plane.

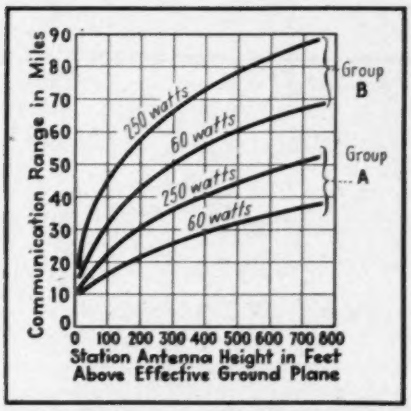
Based on experience obtained to date, these conclusions appear obvious:

1. There is no reason to consider the use of 30 to 40 Mc. AM for a new installation.
2. That new systems where two-way communication is desired, FM will almost invariably be the correct final choice.
3. For new one-way systems over long distances in mountainous terrain, medium frequency AM might be considered.

The desired communication signal is always in competition with all types of static and electrical phenomena causing radio interference. While frequency modulation has remarkable ability to over-ride such interference, yet its range will definitely be extended if low-noise level areas can be selected for the receiver locations.

As in most engineering problems, the final choice is a combination of both engineering and economic considerations. At approximately 40 miles range, the 60 and the 250 watt headquarter systems are, everything considered, of approximately the same cost. Beyond 40 miles range, the lower cost of the lower antenna support permissible with the 250 watt transmitter makes this system less expensive. Below 40 miles, the lower cost of the 60-watt headquarters equipment makes this unit the most favorable investment.

It should be pointed out, however, that additional investment in antenna height, or use of a 250 watt transmitter will always put quieter signals into the mobile units over longer distances and under more adverse conditions of both terrain and interfering noise levels. This is true even though curves have indicated the 60 watt unit to be satisfactory. Such increases in investment pay dividends through increased enthusiasm of the mobile operators for a system which gives them a good solid signal.




**SUCCESSFUL communication range between station and mobile units (30-42 mc) based on experience to date. Group A, high noise levels in cities, etc. Group B, low noise levels in rural districts**

**Budget Estimate for a Typical System, Completely Installed, 250-Watt Headquarters Transmitter with 20 Mobile Units**

| Equipment | Cost Estimate |
|---|---|
| 20-30 watt mobile units..... | $10,000.00 |
| Headquarters equipment..... | 2,500.00 |
| Remote control ..... | 350.00 |
| 2 Pick-up receivers..... | 600.00 |
| 1 200 ft. antenna system..... | 3,000.00 |
| Test equipment..... | 1,500.00 |
| Estimated installed cost..... | $17,950.00 |
| Renewal parts—5 percent..... | 950.00 |
| Estimated total budget..... | $18,900.00 |

Total system average—$945.00 per car.

# *A General Manager writes from Iowa:*

## "In looking over our experience during the past years I can readily see where, in practically all cases, we could have adapted our requirements to enable us to use a standardized product."

BECAUSE the word "standardization" has so many meanings, some of the advantages to the buyer of the *particular type of standardization* which G.E. has proposed for heavy power apparatus may be overlooked. One of the advantages is that the utility company's own engineering talents will be released for the further improvement of system economics.

The standardization we propose is not a "quality freeze" in the sense that a "Grade A" is established for all time. It allows for continual betterment from model to model, based on the service experience of many users. And it aims to produce models of *greater adaptability.*

The skillful application of these models within a power system is a task with considerably greater economic possibilities, we believe, than the arrangement of parts in a single unit.

The writer quoted above recognizes the long-range advantage of this type of standardization to his engineers. He also said: "I am very much in favor of the manufacturers working out a program along this line." *General Electric Company, Schenectady, N. Y.*

**GENERAL ELECTRIC**

201-110-170

*Every week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds.*

**Budget Estimate for a Typical System, Completely installed, 60 Watt Headquarters Transmitter with 8 Mobile Units**

| Equipment | Cost Estimate |
|---|---|
| 8-30 watt mobile units | $4,000.00 |
| Headquarters equipment | 750.00 |
| Remote control | 350.00 |
| 1 Pick-up receiver | 300.00 |
| 1 100 ft. antenna system | 900.00 |
| Test equipment | 750.00 |
| Estimated installed cost | $7,050.00 |
| Renewal parts | $400.00 |
| Estimated total budget | $7,450.00 |

Total system average—$925.00 per car.

From the foregoing examples it is evident that a quick "rule-of-thumb" guide would be to estimate $1,000 per mobile unit as a tentative budget for a completely installed system.

Possible additional expenditures above these equipment costs are:

1. Facilities for housing station equipment.
2. A.C. power supply for station equipment.
3. Wire line cost to remotely installed.
4. Equipment.
5. 170 amp.-hr. batteries for mobile units.
6. Heavy duty battery charging generators for mobile units.
7. Applicable sales or excise taxes.

• • •

# Adapt "A" Base Meters For Socket Mounting

By J. E. MILLER
*General Foreman, Electrical Testing Division*
*Wisconsin Electric Power Co.,*
*Milwaukee, Wis.*

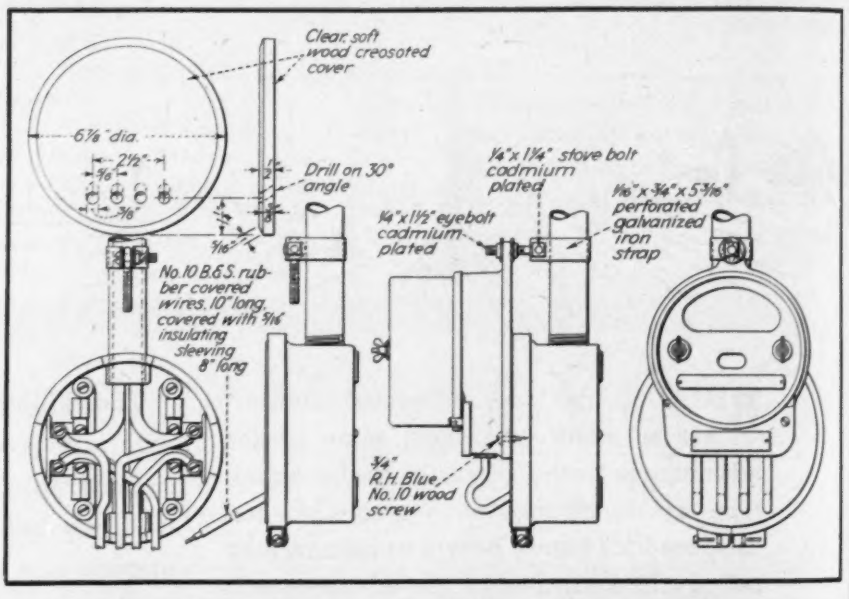
Wisconsin Electric Power Company has developed a method whereby "A" base watthour meters can be mounted directly on socket meter bases. The accompanying illustrations show, in detail, how this has been done.

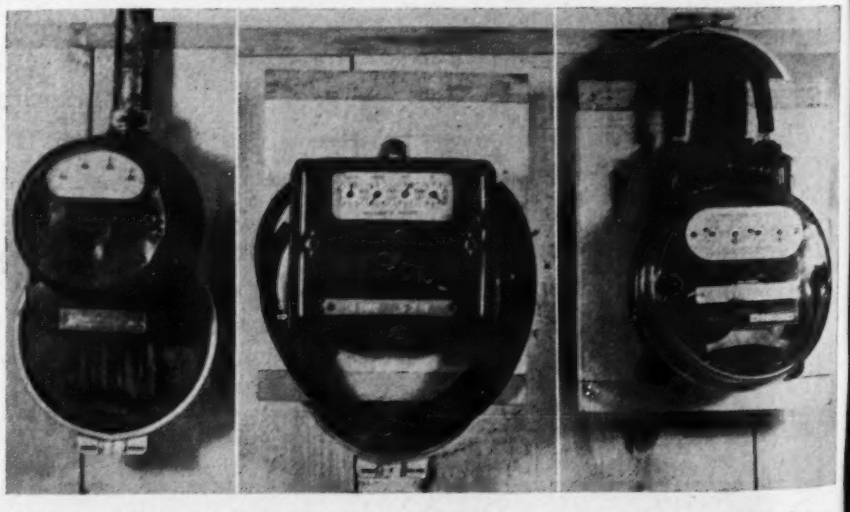
Several years ago the company adopted socket or detachable type meters as standard and required the customer through his contractor to furnish the socket. In September, 1942, the War Production Board stopped the manufacture of domestic watthour meters, chiefly 5 and 15-amp. capacity in the single-phase types. This included both the "A" or standard-base and the "S" or socket-base meters. However, manufacturers had considerable stocks of these meters which lasted until late in 1943, when they were exhausted. It then became necessary to find some kind of substitute.

Contractors in Milwaukee have, in general, had no trouble in obtaining sockets or troughs and have continued to install them on all new installations. When the shortage of socket-base meters became acute, it was necessary either to change our standards, to permit the use of some kind of wood enclosure and an "A" base meter, or to adapt the "A" base meter to fit the socket. The first method would entail considerable work in changing over standards. It is quite expensive to have wooden enclosures built. And there is always the problem of re-conversion to standard construction after the war.

The illustrated scheme for mounting "A" base meters directly on the meter socket was therefore developed as an inexpensive solution. A creosoted soft wood cover, the same size as a blank socket cover, is mounted on the socket and held in place by the sealing ring. Leads are brought out through four holes in the wood cover as shown. The meter is fastened to the cover with wood screws and to the entrance conduit by a piece of perforated strap, one stove bolt and one eye bolt. Details of the mount-in can be varied for different types of meters. This method has the advantage of being very reasonable in cost, easy to convert when socket type meters again become available and obsolete types of meters can be used.

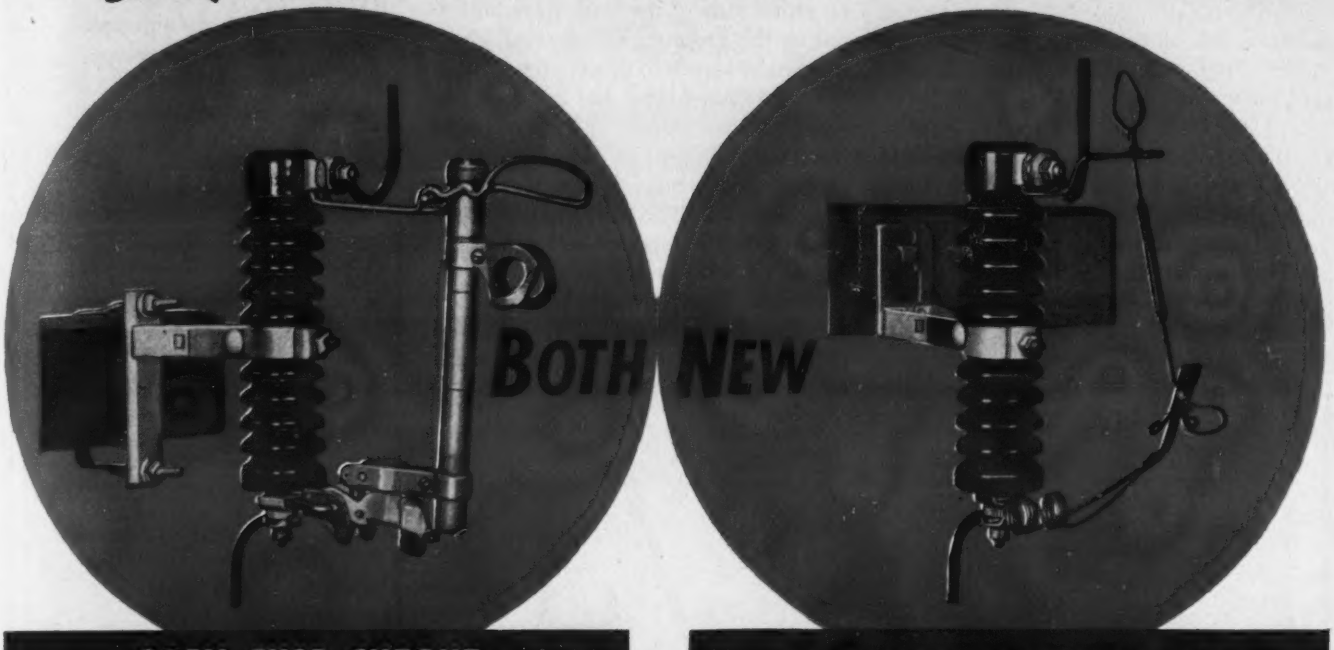
**BELOW—Method of adapting "A" base meters to meter socket mounting**


Clear, soft wood creosoted cover
6⅛" dia.
2½"
⅜"
⅜"
Drill on 30° angle
5/16"
No. 10 B.&S. rubber covered wires, 10" long, covered with 5/16" insulating sleeving 8" long
¼"x 1¼" stove bolt cadmium plated
¼"x 1½" eyebolt cadmium plated
⅛"x ¾"x 5⅜" perforated galvanized iron strap
¾" R.H. Blue, No. 10 wood screw



**A-base, Thompson, and top-connected meters mounted on covers in meter socket bases**

# NOW YOU HAVE A CHOICE OF 2 G-E OPEN-TYPE CUTOUTS




## OPEN FUSE CUTOUT
with drop-out fuse holder

This new G-E cutout (50- and 100-amp ratings for 7500/12,500-Gr-Y and 15,000-volt circuits) combines the operating, safety, and convenience features of the hinged-fuse-holder, drop-open type in a modern construction possessing the following important features:

**INTERCHANGEABLE FUSE HOLDERS,** on 50- and 100-amp cutouts of same voltage rating, reduce your stock requirements.

**SOLID-PORCELAIN INSULATOR,** with undercut petticoats, provides dependable insulation and mechanical strength.

**RECOIL-PROOF FUSE HOLDER** cannot be unseated by recoil forces during operation; an automatic latch locks it on the hinge until the fuse holder drops open.

**TIME DELAY** of hinge toggle keeps contact arms in closed position until the arc is cleared within the fuse holder.

**SILVER-PLATED CONTACTS** and contact arms assure permanently low resistance of contacts.

## FLIP-OPEN FUSE CUTOUT

This new cutout, of the open type but without fuse holder, is specially designed for light-duty circuits, and where the operating advantages of the hinged-fuse-holder design may be considered unnecessary. It is available in 50-amp ratings for 7500/-12,500-Gr-Y and 15,000-volt circuits. Some of its more important features:

**SPRING-CONTACT ARMS** of strong, resilient Copperweld steel assure adequate tension on fuse link and positive separation of blown fuse link when fault occurs.

**SOLID PORCELAIN INSULATOR** same as that used in hinged-fuse-holder design.

**CONTACT ARMS** are attached to the top and bottom of the porcelain insulator in such a way that fixed alignment is assured and side vibration prevented.

**RING** at each end of fuse link makes the link easy to remove with a switch hook.

**SIMPLE CONSTRUCTION;** low cost.

Both cutouts provide positive visual indication of outages; both are easy to fuse. They can be serviced with any standard switch hook. Only a careful study of your particular application will determine which cutout is best suited for your job. Write for Bulletins GEA-1816 and GEA-4224. *General Electric Company, Schenectady 5, N. Y.*

**GENERAL ELECTRIC**

Care must be taken to see that gaskets are tight, washers in place, glasses properly cemented in, etc., if the meters are to be used out of doors as are those illustrated.

So far, approximately 400 installations have been made, and no trouble has developed.

• • •

## Extended Derrick Speeds Construction

During the recent construction of 4½ miles of 66-kv. transmission line by Public Service Company of Indiana, Inc. in its Lafayette division 50 to 70-ft. poles were set, fully-framed, with a truck and improvised A-frame or derrick made of two poles.

A similar derrick, shown, was used to place the conductors on the poles. Throughout the entire construction the poles were climbed only once to do the actual tying in.

The wire reels were placed at one end of the lead and four wires, two on either side of the lead, were pulled out on the ground. The derrick lifted the conductors into place, eliminating the use of hand lines and the need for climbing the poles. After the conductors were pulled with the winch and allowed to slack off naturally, the poles were climbed only once, for the actual tying in operation.

Use of the derrick in the manner described was conceived by J. A. Cahill, superintendent of electric distribution of the Lafayette division to facilitate line construction.

**EXTENDED A-frame derrick shown placing conductors for this 66 kv. line also set the poles fully framed. Linemen climbed the poles once to tie in**

## Enhanced Switch Rating Due to Bimetal Strip

By L. W. DYER
and O. S. JENNINGS
*Westinghouse Electric & Manufacturing Co.*
*East Pittsburgh, Pa.*

Use of bimetallic thermal elements supplemented by a magnetic tripping device makes speedy automatic operation of a recently developed switch possible with overloads of 1,000 percent. The thermal elements in the lower switch ratings (15 to 50 amp.) are directly heated; that is, the current passes through the entire length of the bimetal strip. Those with heavier ratings (70–100 amps.) have semi-directly heated thermal elements. In the latter case, the current passed through one half of the active part of the bimetal, the other half is indirectly heated. This variation in design of thermal elements allows the engineer a wider choice of time-current characteristics in switch selection.

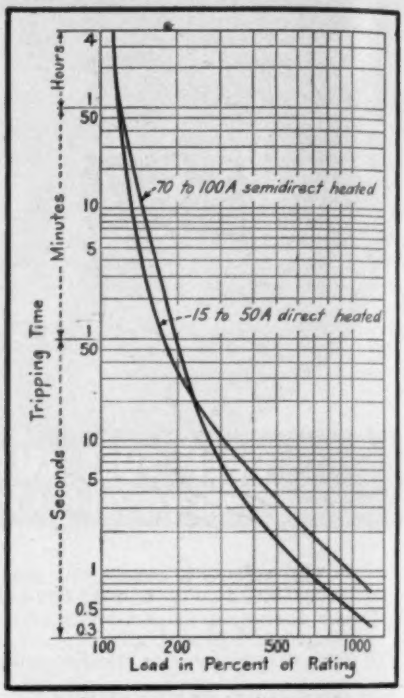



**FIG. 2. Curves denoting different characteristics due to differently constructed bimetal tripping elements**

These thermal elements will not stand a short circuit of 15,000 amp. without taking a permanent set, or failing completely. To overcome this, a pair of short-circuiting contacts operated by the magnetic tripping device armature is used to provide this protection automatically for the sensitive thermal elements. As shown in Fig. 1, these contacts are so arranged

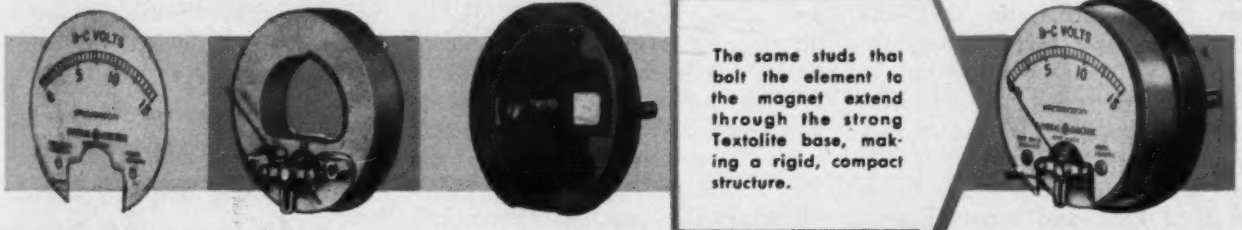
# *New* INTERNAL-PIVOT 2 1/2-inch PANEL INSTRUMENTS ...1 inch deep

Type DW-53 d-c voltmeters, ammeters, and volt-ammeters. Designed to measure voltage and current in battery and battery-charging circuits on naval aircraft. They meet all applicable Navy specifications.

## SEE THE SIMPLICITY AND STRENGTH OF THEIR DESIGN

Note the few simple parts, and how strength is built in by solidly bolting the element to the one-piece, cast-comol magnet.

ELEMENT + MAGNET + BOTTOM BRIDGE = ELEMENT ASSEMBLY



The same studs that bolt the element to the magnet extend through the strong Textolite base, making a rigid, compact structure.

SCALE PLATE + ELEMENT ASSEMBLY + BASE ASSEMBLY = STRONG THIN INSTRUMENT

## ...built for tough jobs and long life

COMBAT service on aircraft and in military radio is the crucial test for any electric instrument. To meet the requirements of such severe service, G-E engineers went to extremes to gain simplicity and strength in the design of these new panel instruments.

What isn't shown clearly in the pictures above is the internal-pivot construction and how the pivots are mounted to the inside of the armature shell instead of being secured to the outside of the armature winding. The pivot shank actually extends through the armature shell, and is anchored firmly on both sides of the shell by pressing two brass washers over the pivot shank. This construction makes the entire element assembly 20 per cent thinner.

There are many other features: large-radius pivots, hard-glass jewels, good damping, and ample clearances between stationary and moving parts. Added up, these features give you an instrument well able to withstand vibration and hold its rated accuracy.

If you want the complete story of how these instruments pack all-round fine performance in a small space, ask our nearest office for Bulletin GEA-4064, which covers instruments used for radio and other communications equipment; or Bulletin GEA-4117 which describes those suitable for naval aircraft. *General Electric Co., Schenectady 5, N. Y.*

**GENERAL ELECTRIC**

802-45-8200

For radio and other communications service: Type DW-51 d-c voltmeters, ammeters, milliammeters, microammeters; Type DW-52 radio-frequency ammeters (a-c thermocouple-type). Cases are brass or molded Textolite.

HEADQUARTERS FOR ELECTRICAL MEASUREMENT

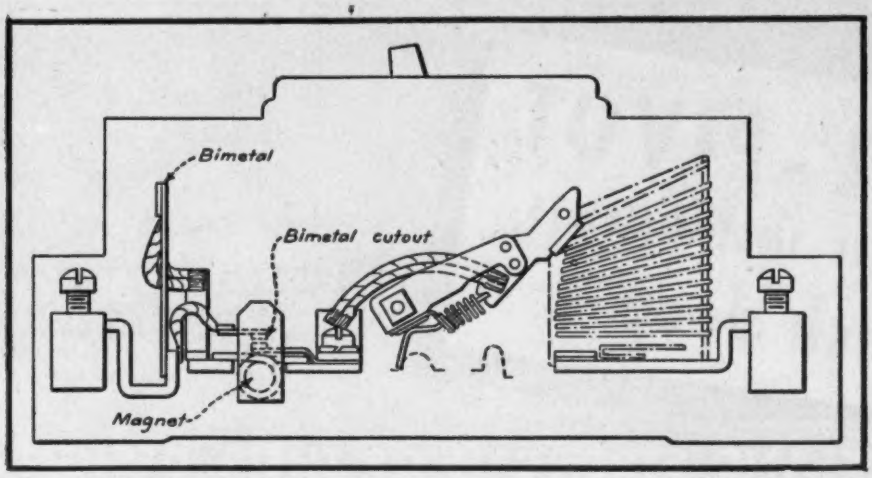



FIG. 1. Switch with bimetal strip, magnet and cutout

to provide a parallel path around the bimetal elements when closed. The upper contact is a part of the magnetic trip armature which operates to trip the breaker at current values approximately ten times the breaker rating. On currents approaching short circuit values, the short circuit contacts close in 0.0005 seconds, thus limiting the current which flows through the bimetal element and protects it from potential harm.

• • •

## Tough Economizer Deposit Formation

Bonded deposit formations on economizer heating surfaces in all cases contain sulphuric acid and alumipa in some form. These deposits as well as loose dust on the nearby shelves were analyzed and the results are shown in Table I as they appeared in the paper by J. R. Rylands and J. R. Jenkinson of E. Green and Son, Ltd., and reported at a recent joint meeting of the (British) Institution of Electrical Engineers and the (British) Institution of Mechanical Engineers. Two conditions that affect the formation of these deposits are the temperature of the feedwater and the completeness of combustion in the boiler.

Sulphur content in the hard deposit is greater than that in the loose dust which showed no tendency to cake or bond. Therefore, it must lack some essential factor which is associated with the economizer tube. Because of this and because the tubes are at a lower temperature than the dust laden gas that passes over them, many investigators have been led to the conclusion that bonded deposit formation is a dew point phenonemon. Yet this cannot be the only cause since these deposits also form above dew point temperatures.

In the analysis of the bond, aluminum sulphate occurs in quantity in all hard deposits. After studying this compound, it was realized that should hydrated aluminum sulphate form in the deposit, and, at a later heat stage, above 420 deg. F., be thrown out of solution, it would pass through the "glutinous" condition and present a surface on which dust could adhere, and, finally result in a bonded deposit having the familiar characteristics. (IEE Paper "Bonded Deposits on Economizer Heating Surfaces" June 1943).

It was further determined that when an economizer is first put into operation it may have a long period of immunity due to the absence of sulphuric acid on the tubes; and that film must exist before the growth of bonded deposit can commence. The only direct source of sulphuric acid is from the sulphur trioxide in the gases and the necessary moisture can be deposited only when the tubes are below the dew-point temperature of the gases. These conditions occur when a plant first starts up, sacrificing many months of possible immunity from bonded deposits. It is also stated that by the use of pulverized fuel, comparative immunity is given by the low sulphur trioxide content of the air and the presence, in this type of firing, of the much less soluble forms of aluminum compounds.

If any one of the following stages can be inhibited, subsequent stages can be prevented from occurring; the earlier in the series the inhibition takes place the better the results of preventing the accumulation of bonded deposits on the tubes. a. Prevent original film of sulphuric acid on the tubes. b. Prevent the attack on the tubes by the acid. c. Prevent the formation of ferric sulphate (catalytic agent) from ferrous sulphate. d. Stop adherence of fly ash to acid film. e. Prevent attack by acid on alumina in the fly ash. f. Counteract formation of aluminum sulphate which is later thrown out on the surface.

| | Characteristic Compositions | | | |
|---|---|---|---|---|
| | Station X | | Station Y | |
| | Hard Deposit | Loose Dust | Hard Deposit | Loose Dust |
| Moisture | 2.10 | 0.09 | 2.35 | 1.22 |
| Ash | 82.80 | 57.50 | 68.60 | 78.90 |
| Insoluble in Water | 82.18 | 98.00 | 58.54 | 82.89 |
| Soluble in Water | 17.82 | 2.00 | 41.46 | 17.11 |
| Total S as $H_2SO_4$ | 8.42 | 0.84 | 38.98 | 13.82 |
| **Soluble Portion** | | | | |
| Ferric Sulphate | 0.28 | Nil | 35.00 | 5.65 |
| Aluminum sulphate | 8.36 | Nil | 12.00 | 0.00 |
| Calcium sulphate | 1.70 | 0.73 | 2.99 | 4.74 |
| Sulphuric acid | 5.88 | Nil | 21.60 | 5.44 |
| Note: Aluminum sulphate was hydrated in Station X analyses and dehydrated in Station Y analyses. | | | | |
| **Insoluble Portion** | | | | |
| Iron oxide | 0.64 | 0.04 | 15.26 | 10.74 |
| Aluminum oxide | 39.97 | 17.88 | 13.45 | 30.36 |
| Silica | 16.40 | 17.44 | 12.95 | 28.90 |
| Calcium sulphate | Nil | 0.44 | Nil | 5.76 |
| Calcium oxide | Nil | 2.12 | Nil | Nil |
| **Water Temperatures** | | | | |
| Inlet | 275 deg. F. | | 320 deg. F. | |
| Outlet | 356 deg. F. | | 392 deg. F. | |

•

## Emergency Supply for Air-Operated Breakers

Assurance of emergency supply to air-operated oil circuit breakers on 132-kv. lines entering and leaving the Roanoke substation of the Appalachian Electric Power Co. was provided at small cost. In the shop in the substation yard from which maintenance work is done is an automatic compressor supplying air for cleaning, spray painting and other purposes in the shop and yard. The unit compressors on the breakers normally hold the operating air at 160 psi. but the pressure can fall as low as 90 or 100 and the breakers will still operate. That being so, then the 125 psi. available from the shop compressor would be perfectly satisfactory as standby in case of failure of any of the breaker compressors. So, short connections were run from the yard air piping to the breaker air tanks and now if the low-air alarm sounds from any breaker it is simply a matter of closing one valve and opening another to assure air for breaker operation.

# The LOW-COST Cable that pays HIGH DIVIDENDS...

● From a plain dollars-and-cents viewpoint, to electric light and power companies the most important cable advance in recent years is the development of *gas-filled* cable—introduced by G.E. in 1938.

This simply designed cable, which is not affected by profile and which is self-supervising, gives you the advantages of oil-filled cable at practically solid-cable cost.

A General Electric gas-filled-cable system needs no reservoirs, no special accessories in the manholes. Simple equipment *at one end of the line* is all that is required to keep a safe, even, gas pressure under all conditions of temperature and terrain. Furthermore, because of gas-filled cable's self-supervisory feature, you have automatic warning in case of a sheath rupture, and as a result, maintenance costs can be kept surprisingly low.

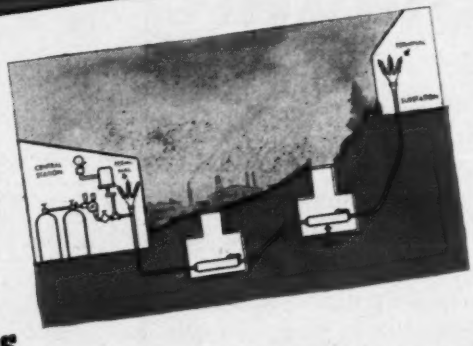
THE COST of G-E gas-filled cable is generally close to that of solid cable, within the solid-cable voltage range. For higher voltages, gas-filled cable is less expensive than any other type.

For detailed information on Type GF cable, write or call our local office. *General Electric Co., Schenectady 5, N. Y.*

**Gas-filled CABLE**

BUY WAR BONDS

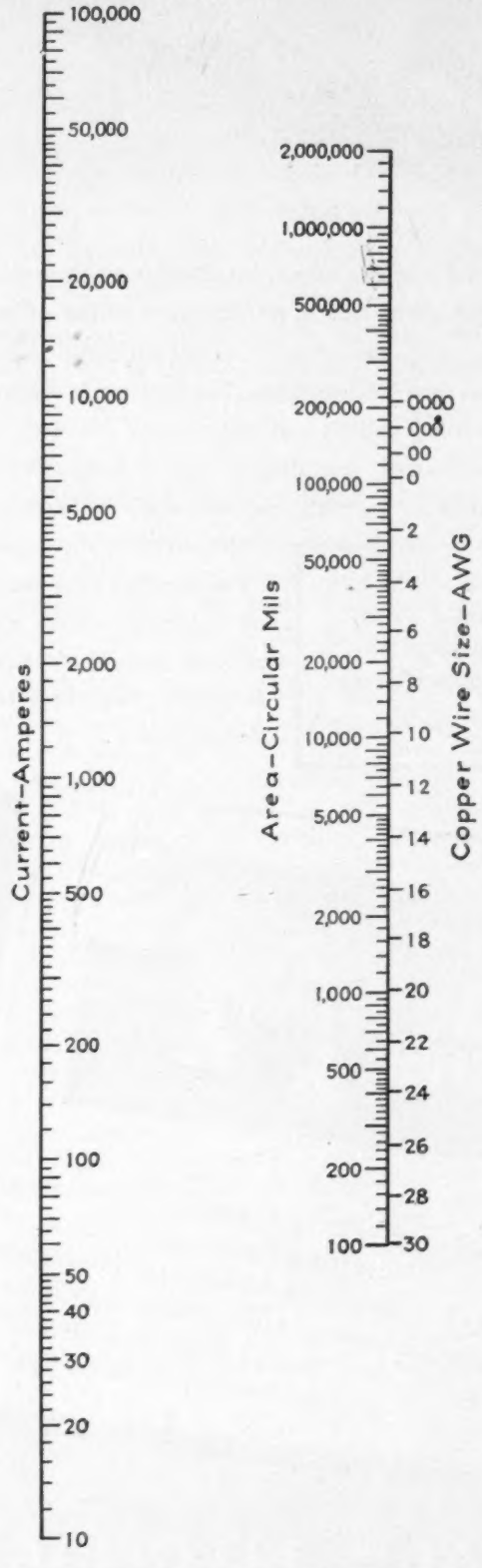
## A simple, easily maintained system for 10- to 70-kv lines



Note in this diagram how standard nitrogen cylinders, at station or terminal, supply gas to lines through pressure relay and alarm equipment. Since there is sufficient volume of gas in the cable system to take care of daily load-temperature requirements, and because adjustments for changes in seasonal ambient temperatures are required only twice a year, manual control proves simple and satisfactory.

GENERAL ELECTRIC

# SHORT-TIME CURRENT REQUIRED TO MELT COPPER CONDUCTORS*




***Graphical determination of bare copper wire fusing characteristics is possible with the accompanying chart based on an equation by I. M. Onderdonk***

The equation is:

$$33\left(\frac{I}{A}\right)^2 S = \log_{10}\left(\frac{t}{274}+1\right)$$

in which

$I$ = Current, amperes
$A$ = Cross sectional area of conductor, cir. mil
$S$ = Time current is applied, seconds
$t$ = Temperature rise of copper, deg. C., = 1,083—40

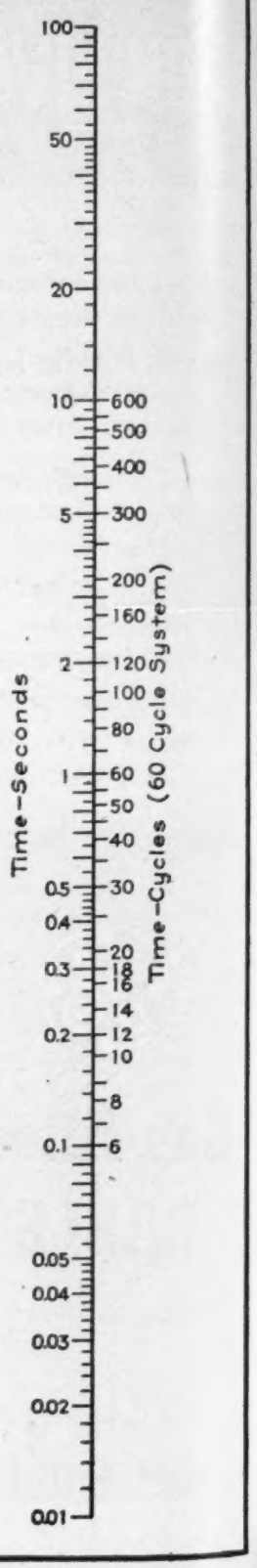
where

1,083 deg. C., is melting point of copper
40 deg. C., is assumed ambient temperature

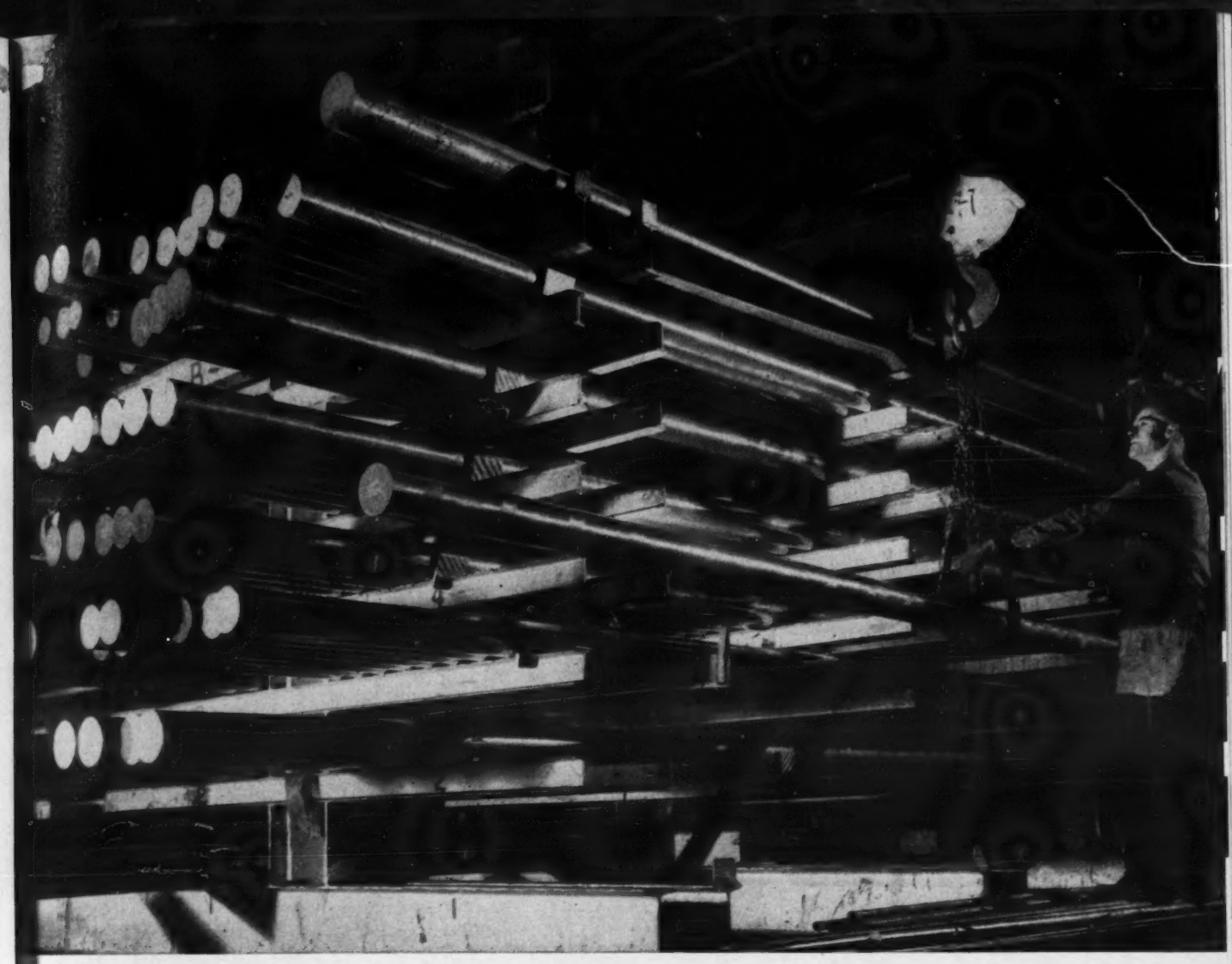
Other assumptions are that the resistance of copper is 1.589 micro-ohms per cm³., at 0 deg. C., and the temperature coefficient of copper at 0 deg. C., is 1.234.

This is an approximate method in that it applies only to short periods of time and heat storage only in the copper itself is considered. Convection losses due to air currents and radiation both are neglected.

In using this chart for a specific wire size, if current is known, the time in seconds required to fuse the wire can be determined. Conversely, if the desired fusing time in seconds is known the current required can be determined. Or, if current of a known value is to be passed for a specific period the wire size that will just fuse under these conditions can be found. Connection if the two known values by a straight line, and extension of this line to the appropriate third scale on the chart will give the desired value.




* Chart from engineering department of a midwestern utility



# STEEL—*Quick Shipment*

**JOSEPH T. RYERSON & SON, INC.**

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DETROIT.....1600 E. Euclid Ave.
Madison 3860
ST. LOUIS.....5 Clinton St.
Central 1020
CINCINNATI..Front St. and Freeman Ave.
Cherry 3232
CLEVELAND....E. 53rd and Lakeside Ave.
Henderson 1000
PITTSBURGH.....330 Grant St.
Walnut 7540; Carnegie 795
PHILADELPHIA.....5200 Grays Ave.
Bell-Belgrade 1412; Keystone-West 1644
BUFFALO.....40 Stanley St.
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NEW YORK.....203 Westside Ave.
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Your nearby Ryerson plant carries a large stock of practically every kind of steel you need. All the various shapes and sizes —hot rolled, cold finished and heat treated—in carbon, alloy, stainless and tool steel grades, are ready for immediate shipment. Special steels—free-machining, forging, heat treating or for other processing—are also included. All Ryerson alloy steels are identified with heat symbols stamped or tagged on the bars. Complete test data on analysis, hardenability response and obtainable physical properties for 1, 2, 3 and 4 inch rounds quenched and drawn at 1000°, 1100° and 1200° F., is furnished with each alloy shipment.

If you are faced with the possibility of cutbacks or contract terminations, we suggest that you keep your own steel inventory at a practical working level and avoid the risk of loss. Rely on Ryerson to supplement your stocks. Whenever you need steel, call Ryerson for quick action.

BUY U. S. WAR BONDS

**RYERSON**

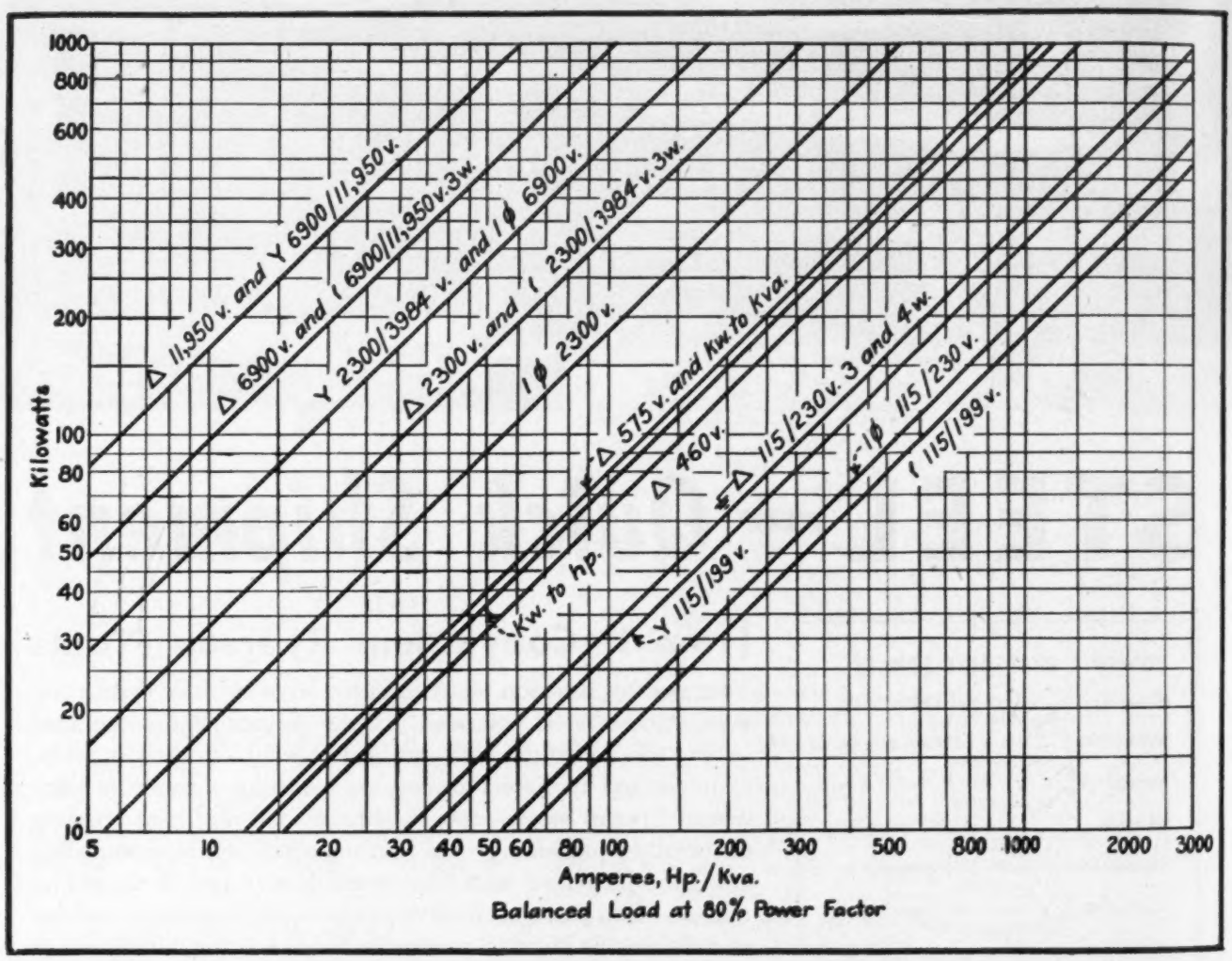
# CHART FOR CONVERTING KILOWATTS TO AMPERES AT VARIOUS VOLTAGES

By E. B. HICKS, Superintendent, Meter Department, Carolina Power and Light Co., Raleigh, N. C.

Accompanying chart may be used to convert kilowatts to amperes per phase, or the reverse, for 15 types of circuits up to 11.95 kv. Other types of circuits may be added if advisable. All calculations are based on balanced loads at 80 percent power factor. The chart may also be used to convert kilowatts to horsepower, or the reverse. The delta 575-volt curve may be used also to convert kilowatts at 80 percent power factor to kilovolt-amperes. Other useful conversion curves are also included.

Symbol designations are:

- Δ = Delta
- Y = Wye
- ⊬Δ = Delta with center of one winding grounded
- ℓ = Two "hot" wires and neutral off wye.



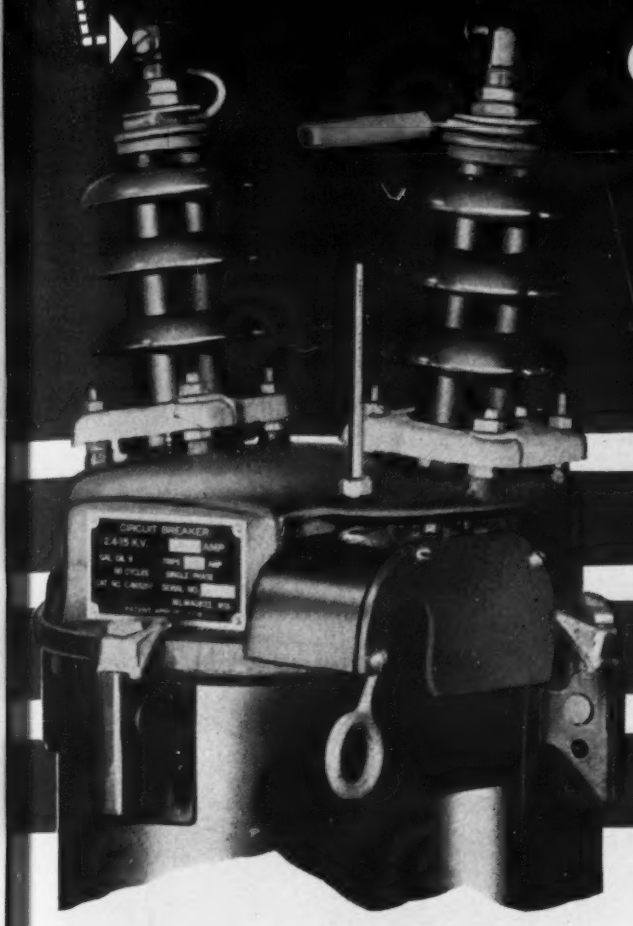

## EXAMPLE FOR USE OF CHART

Problem—What size current transformer will be required to handle an estimated load of 400 kw. which is to be metered at 575 volts, delta?

Solution—Proceed out the horizontal line opposite 400 kw to the delta 575-volt curve. The vertical line that crosses the intersection of the horizontal and the slanting lines represents the current per phase, which in this case is 500 amperes.

For loads above 1000 kw. move the decimal point to the left, e.g., for 3500 kw., look up 350 kw. on the chart and multiply the resulting amperes by 10.

# KYLE
# Oil Circuit Breaker is
# Triple Safe



**Normal Position of the Breaker is Open··**

**Operating Handle and Tank Always Dead··**

**No Terminal in Bottom of Tank··**

## Why Kyle Oil Circuit Breaker Affords Maximum Line Protection

It is the only circuit breaker with positive dependable hydraulic timing.

•

It has high interrupting capacity and will not fail in protecting the line. It is electrically and mechanically sound.

•

It is so designed that each opening is fast and each closing requires an interval of three seconds. Most faults are cleared automatically on the first opening.

•

It will reset itself for a complete cycle of operations up to lock-out on the fourth operation in a series.

•

Ratings: Volts 2300 to 15,000. Amperes: 3 to 50. Minimum Tripping Current: 8 to 102 amperes. Interrupting Rating: 120 to 2000 amperes. Weight 135 pounds with oil.

The Kyle Oil Circuit Breaker is so designed that it not only protects the lineman, but also protects itself, and thereby affords the greatest protection to your lines and service.

The terminals located at the top of the breaker bushings are the only exposed live parts of the Kyle Oil Circuit Breaker. The normal position of the breaker is open which assures that a locked out breaker is harmless to life and property.

The breaker cover is "dead," the tank is "dead," the operating handle is "dead." These features make for easy pole mounting without danger to linemen.

The thermal trip device within the breaker prevents burning up due to overloads by locking out the breaker when a temperature of approximately 200° F. is reached.

The breaker is protected from lightning by external flash-over gaps so that no electrical stresses are imparted to the breaker by lightning surges.

All parts of the Kyle Oil Circuit Breaker are completely sealed from exposure to the elements.

KYLE CORPORATION

SOUTH MILWAUKEE, WISCONSIN

# G-E PAVES THE WAY FOR

## General Electric Presents Two More Postwar Lighting Interpretations!

How can the lighting industry give its customers the full benefit of modern lighting techniques in the lighting of postwar homes, stores and offices?

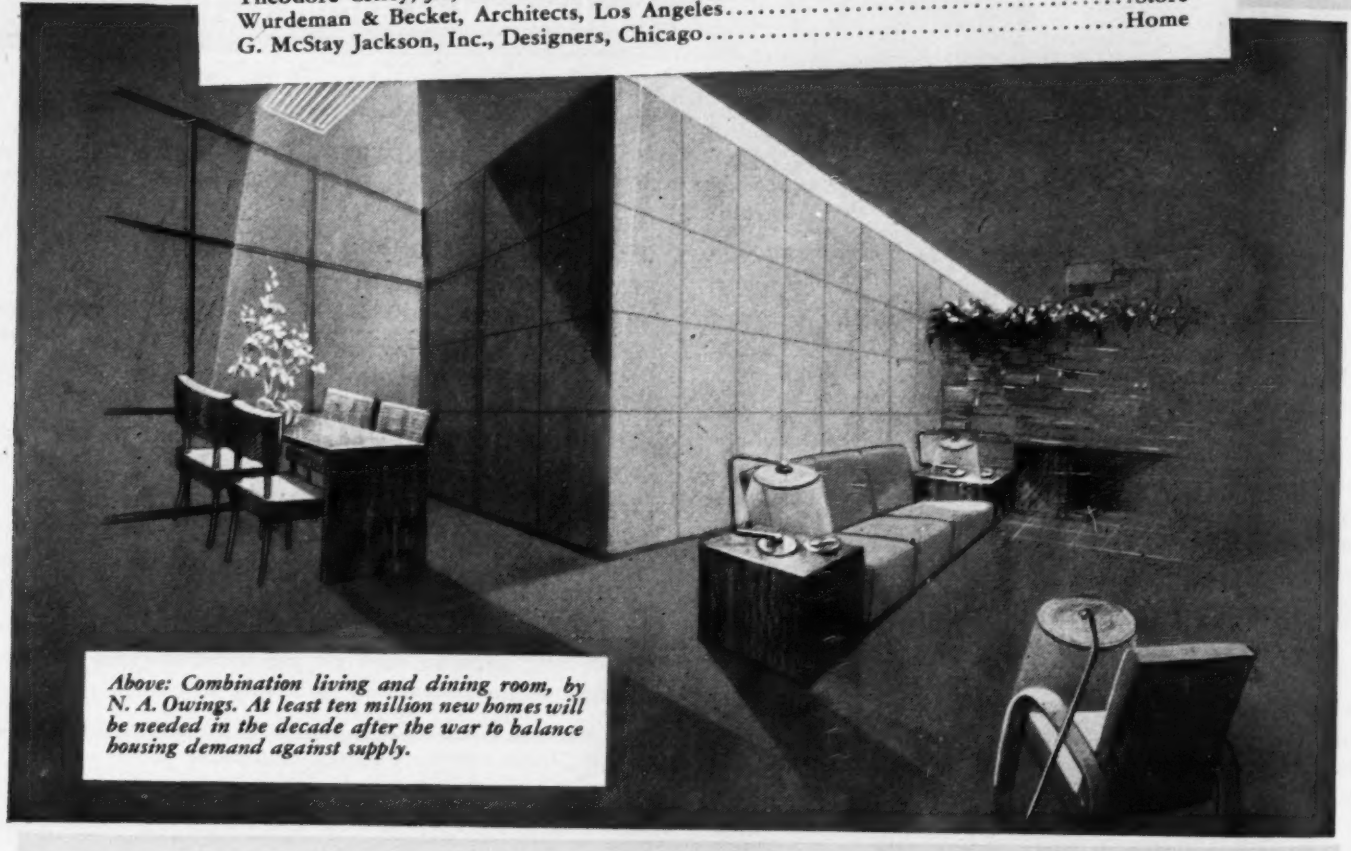
Ten architects and designers have been commissioned by General Electric to work out their answers to that question. Two examples of their work are illustrated below. They contemplate a radical improvement over existing standards, but one that will be practicable with tools that exist today or can be made available quickly as soon as conditions permit.

Complete details of these two postwar lighting plans developed by Mr. Owings and Mr. Arens will be made available in the near future.

Meanwhile, if you would like booklets describing results of the first two G-E commissions, (a postwar food store and a postwar drug store) please write to Div. EW-F, G-E Lamp Department, Nela Park, Cleveland, Ohio.

### THESE ARE THE ARCHITECTS AND DESIGNERS AND THE JOBS THEY ARE DOING

Morris Sanders, Architect, New York.....Food Store
J. Gordon Lippincott, Industrial Designer, of Dohner & Lippincott, N. Y.....Drug Store
Egmont Arens, Industrial Designer, New York.....Small Department Store
Helmuth Bartsch, Architect, of Holabird & Root, Chicago.....Home
Graham, Anderson, Probst & White, Architects, Chicago.....Department Store
N. A. Owings, Architect, of Skidmore, Owings & Merrill, Chicago and New York.....Home
William Edward Kapp, Architect, Detroit.....Office
Theodore Criley, Jr., Architect, Los Angeles.....Home
Wurdeman & Becket, Architects, Los Angeles.....Store
G. McStay Jackson, Inc., Designers, Chicago.....Home



*Above: Combination living and dining room, by N. A. Owings. At least ten million new homes will be needed in the decade after the war to balance housing demand against supply.*

# GENERAL ELECTRIC

*Hear the General Electric radio programs: "The G-E All-Girl Orchestra" Sunday 10 p. m. EWT, NBC; "The World Today" news, every weekday, 6:45 p. m. EWT, CBS.*

# POSTWAR LIGHTING PROGRESS

## Read What People Say About G-E's Design Program:

COMPLETE information on the plans and suggestions of all these outstanding architects and designers is being placed at the service of the architectural profession, fixture manufacturers, lighting companies and the potential buyers of better lighting. Advertising coverage includes scores of magazines.

Dozens of comments already have been received, welcoming the project as a major contribution to better postwar lighting. These are just a few:

"Will greatly assist in stimulating postwar lighting business."

"You are to be congratulated for the development of these visualizations."

"Installations of this kind are certainly right up our alley."

"All of us here feel that you are taking a very constructive step to higher lighting standards in anticipation of tremendous postwar activity."

"You could hardly have selected a theme of greater current interest."

"Should prove of great interest to all who are now attempting to formulate their postwar modernization plans."

"The architectural program on postwar lighting is certainly a good one and, from our point of view, it is mighty encouraging."

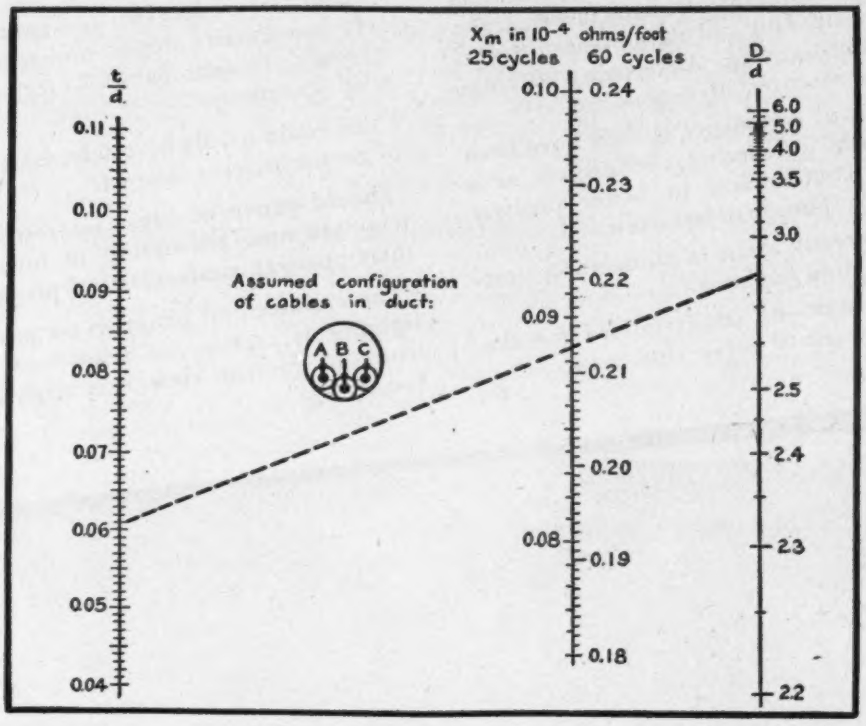
*This department store budget shop by Egmont Arens, is typical of the way modern lighting for selling can be put to work in the 1,500,000 commercial establishments that will need relighting after the war.*

**G-E MAZDA LAMPS**

KEEP BUYING WAR BONDS — KEEP THE WAR BONDS YOU BUY

# DETERMINATION OF SHEATH LOSSES FOR THREE SINGLE-CONDUCTOR CABLES PER DUCT

By L. G. MCDOWELL, Assistant Engineer, Consolidated Edison Co. of New York, Inc.




**Use of Chart:** Determine ratio of $t/d$ and $D/d$ for the particular cable and duct size. Connect these two points on the chart with a straight edge and read the value of $X_m$ for either 25 or 60 cycles on the center scale.

**Example:** For three single-conductor 1,000,000-cir. mil cables in a 5 in. duct operating at 13 kv., 60 cycles, where $D = 5$ in., $d = 1.78$ in. and $t = 0.109$ in.: $t/d = 0.061$, $D/d = 2.82$ and, from the chart, $X_m = 0.213 \times 10^{-4}$ ohms per ft. Taking $R_{sh} = 2.27 \times 10^{-4}$ ohms per foot at 77 deg. C. and $R_{cu} = 0.140 \times 10^{-4}$ ohms per foot at 82 deg. C., the average ratio of sheath loss to copper loss may be calculated to be 0.141.

When large sizes of single-conductor cables are installed three per duct for three-phase service, the effect of sheath losses should be taken into account when determining the current-carrying capacity of the cables.

The average ratio of sheath losses, $W_{sh}$, to copper losses, $W_{cu}$, may be expressed as:

$$\frac{W_{sh}}{W_{cu}} = \frac{R_{sh}}{R_{cu}} \times \frac{X_m^2}{R_{sh}^2 + R_{cu}^2}$$

where $R_{sh}$ = Resistance of lead sheath
$R_{cu}$ = Resistance of conductor
$X_m$ = Mutual reactance of sheath and conductors
(all in the same units, such as $10^{-4}$ ohms per ft.)

and $X_m = 2\pi f \times 0.1404 \log_{10} \frac{S}{r_m} \times 10^{-4}$ ohms per ft.

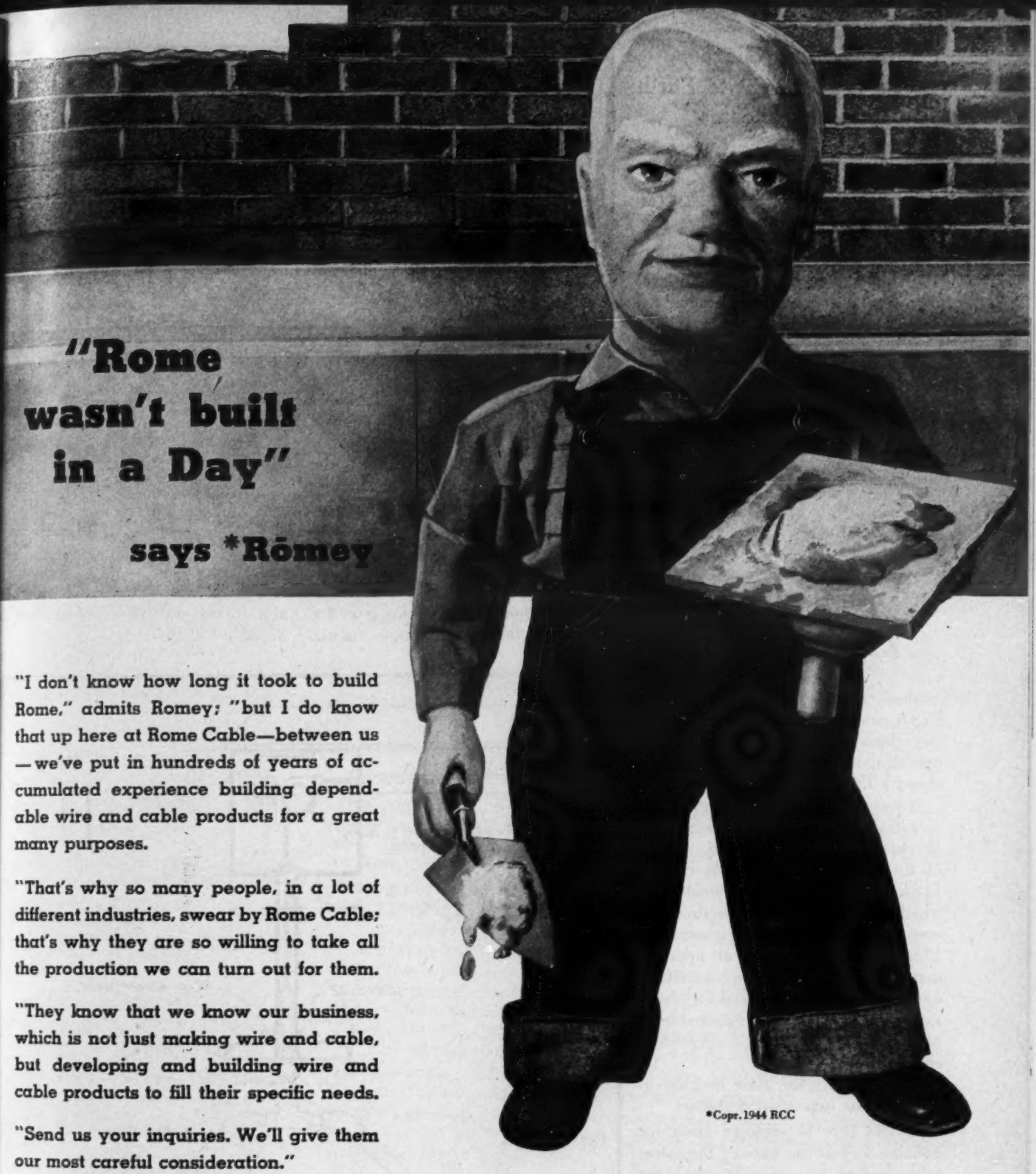
where $f$ = Frequency in cycles per second
$S$ = Spacing of conductors in duct in inches
$r_m$ = Mean radius of lead sheath in inches

Assuming the average configuration of the cables in the duct to be around the inner surface of the duct with sheaths touching, the equivalent value of $S$ may be obtained by taking the cube root of the product of the three conductor spacings: A to B, B to C, and C to A. Expressing this value of $S$ in terms of duct and cable diameters and the value of $r_m$ in terms of cable diameter and lead sheath thickness, the expression for $X_m$ becomes:

$$X_m = 2\pi f \times 0.1404 \left[ \log_{10} \frac{2d}{d-t} + \frac{1}{3} \log_{10} 2\sqrt{1 - \left(\frac{d}{D-d}\right)^2} \right] \times 10^{-4} \text{ ohms per ft.}$$

where $d$ = Overall cable diameter in inches
$t$ = Lead sheath thickness in inches
$D$ = Inner diameter of duct in inches

The solution of this equation is readily obtained from the accompanying chart.



# "Rome wasn't built in a Day"

## says *Rōmey

"I don't know how long it took to build Rome," admits Romey; "but I do know that up here at Rome Cable—between us—we've put in hundreds of years of accumulated experience building dependable wire and cable products for a great many purposes.

"That's why so many people, in a lot of different industries, swear by Rome Cable; that's why they are so willing to take all the production we can turn out for them.

"They know that we know our business, which is not just making wire and cable, but developing and building wire and cable products to fill their specific needs.

"Send us your inquiries. We'll give them our most careful consideration."

*Copr. 1944 RCC

FROM BAR TO FINISHED WIRE

# ROME CABLE CORPORATION

ROME • NEW YORK

# Conductor and Glaze Brought to Earth

By M. M. DEVORRIS
*Electrical Engineer*
*and*
C. W. HAGBERG
*Civil Engineer*
*Pennsylvania Edison Co., Altoona, Pa.*

A method of lowering samples of glaze-laden conductor to ground level for examination is now the standard practice of the Pennsylvania Edison Company and it facilitates scheduling of deglazing operations. This new method employs a rack arrangement, Fig. 1, which has been in use through two glaze formation periods, and no operating difficulties have been experienced with the mechanism.

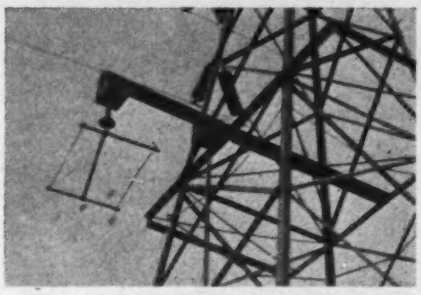


**FIG. 1. Glaze rack outrigged from tower near conductor level**

It was decided to install a glaze observation point at the top of Summit Mountain, elevation 2,400 ft., on one of the towers of the double circuit, 115-kv. steel tower transmission line which is convenient to a main highway crossing. A type of glaze rack which could be placed at approximately the elevation of the conductors, and which could be lowered for observation, was, of course, desirable if observations were to be accurate and effective.

The design of the glaze rack incorporates two important features:

1. The rope is enclosed from the housing box at the base of the tower to the end of the outrigger, where the glaze bus is attached. At this point a conical shield is provided to prevent the formation of ice at the point where the glaze rack suspension device enters the outrigger. In this manner the pulley mechanism, as well as the rope, is protected throughout against ice formation, which might jam the lowering arrangement. The lower end of the pipe terminates in standard large-size meter box.

2. Two 50-in. No. 4/0 copper wire buses are provided on the glass-rack frame, one of which can be removed for weighing purposes by the operation of two thumb nuts, whereas the second one is left in place. In this manner one bus will continue to give the true observation data if the ice is damaged on the other during the weighing process.

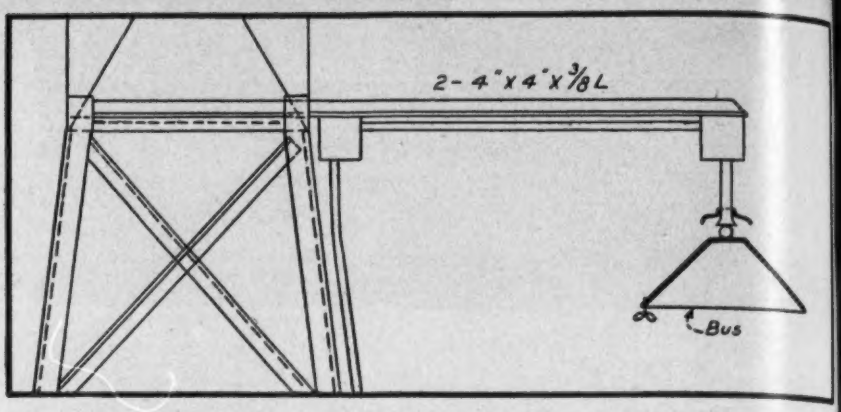



**FIG. 2. Pulley cord, protected from ice, raises and lowers glaze-rack**

Following table of weights indicates the equivalent radial thickness of ice on the overhead transmission circuit. In the field the specimen is weighed and the data reported to the system operator.

| Bus and Ice | Pounds |
|---|---|
| Bus (one 4/0 wire 50 in. long).... | 2.671 |
| plus ice, radius in inches | |
| ¼ ..... | 3.573 |
| ½ ..... | 5.121 |
| ¾ ..... | 7.301 |
| 1 ..... | 10.117 |
| 1¼ ..... | 13.572 |
| 1½ ..... | 17.668 |

*Example:* Weight of two-wire bus and frame plus 1½-in. radius ice is 85/35=120 lb.

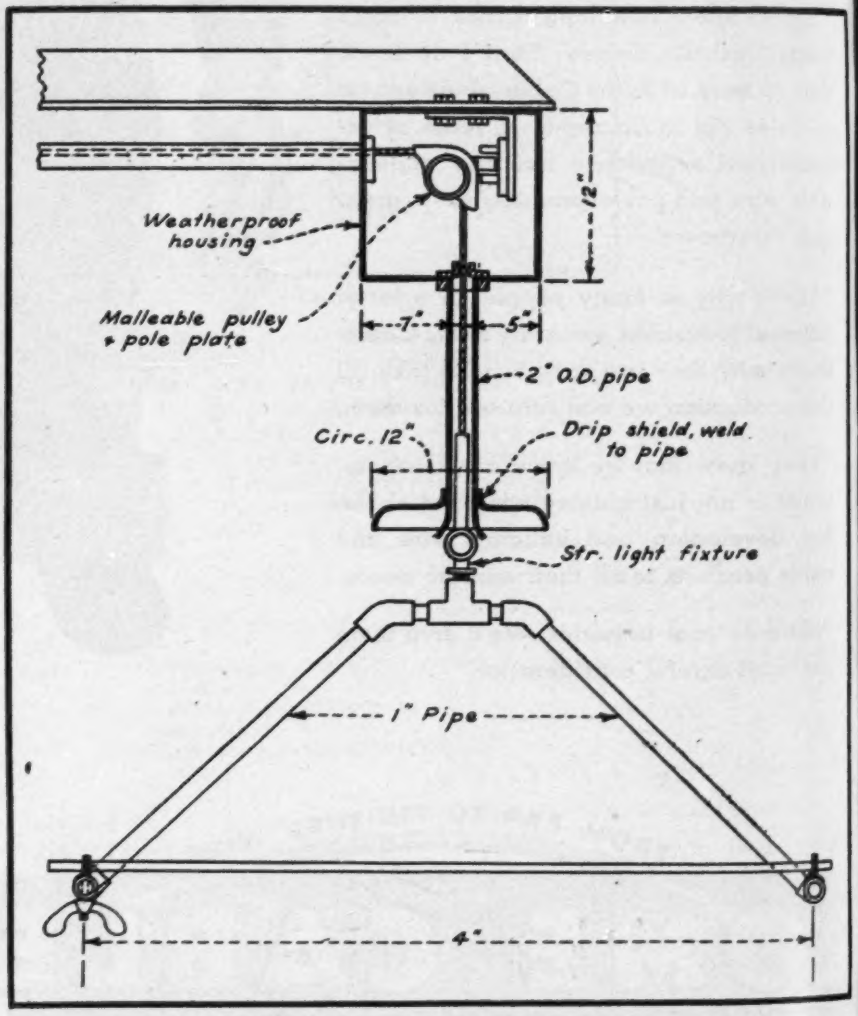
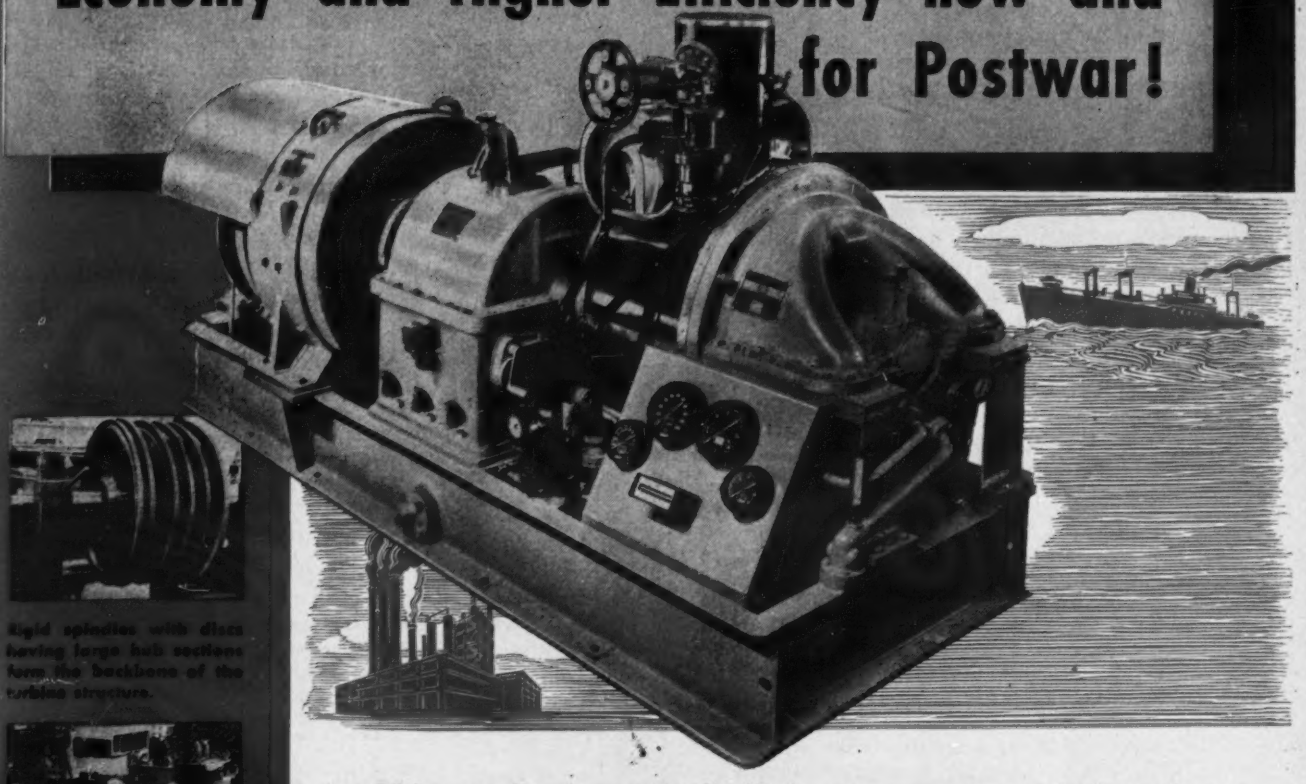



**FIG. 3. Frame, pulley and weather-proof housing. Similar pulley and housing at the tower**

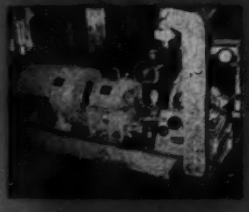
# HENDY'S NEW TURBO-GENERATOR Assures Economy and Higher Efficiency now and for Postwar!





Rigid spinetion with discs having large hub sections form the backbone of the turbine structure.

Production-line assembly of Hendy turbines is possible, through the application of exacting dimensional-control systems.



A portion of the extensive testing stands where exhaustive tests are given each Hendy Turbo-generating plant before it is marked "OK for shipment."

This smooth, compact Hendy Turbo-generator plant is built to the rigorous requirements of war service. Proving its economy of operation and higher efficiency under today's exacting demands, it will be ready to serve in many marine and industrial uses of the postwar era.

Among the features that distinguish this new Hendy power plant are:

1. Fabricated steel reduction gear case encloses the oil pump, priming pump, governor and its power unit, and the high-speed pinion coupling.
2. New-type, simplified governing mechanism requiring no stuffing boxes or soft packing, insures closer speed regulation and uniform output.
3. Parts subject to normal wear or periodic inspection are designed for maximum accessibility to reduce time required for servicing.
4. Location of filters, strainers, coolers and controls eliminates much piping and increases over-all efficiency.

Hendy Turbo-generators can be built to your exacting requirements in a range of 250 to 750 kw. Larger ratings are being designed. Your inquiries are invited.

## JOSHUA HENDY Division

### JOSHUA HENDY IRON WORKS

SUNNYVALE, CALIFORNIA

Branch Offices: BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • ST. LOUIS • WASHINGTON • LOS ANGELES

TURBO-GENERATORS REDUCTION GEARS STEAM TURBINES DIESEL ENGINES

Weight of sample 5 lb., 2 oz., would be equivalent to ½ in. radial thickness of ice on line conductor.

The rope used should be impregnated with oil or wax to eliminate the possibility of absorption of moisture. The 2-in. pipe (economizer tube), which extends up the tower, should be attached to the diagonals with straps.

By telephone located about 400 ft. from the tower, the observer has been able to provide the system operator with excellent data regarding the progress of the glaze formation. For this reason no wire failures have been experienced due to the use of this glaze formation data and better scheduled deglazing operations have resulted. In past years a number of conductor failures were experienced on these two circuits due to the glaze formation being too far advanced for deglazing to be effective.

•

## Transformer Redesign Saves 40% Weight

By R. D. RUNG
*Westinghouse Electric & Manufacturing Co., Sharon, Pa.*

Major design changes in dry-type transformers have been incorporated in new models recently developed as a result of war needs. Critical materials have been conserved through use of "Hipersil" steel cores. Savings of 36 percent in copper and 50 percent in steel result in an overall reduction of 40 percent in weight.

Essentially a dry-type natural-draft transformer, Class B insulation is used and the design permits an 80 deg. C temperature rise above 40 deg. C ambient, in accordance with A.S.A. standards. Overloads considerably beyond the point at which transformers with Class A insulation fail can be safely handled.

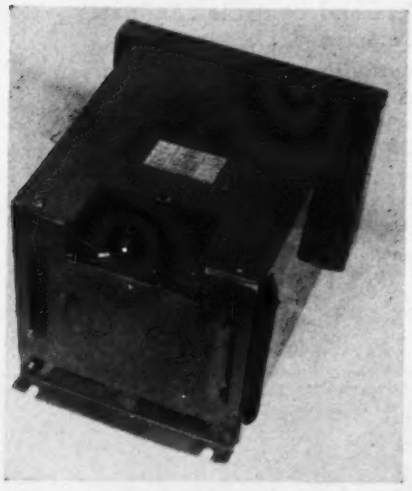


FIG. 1—Exterior view of wall-mounted dry-type transformer; cover removed

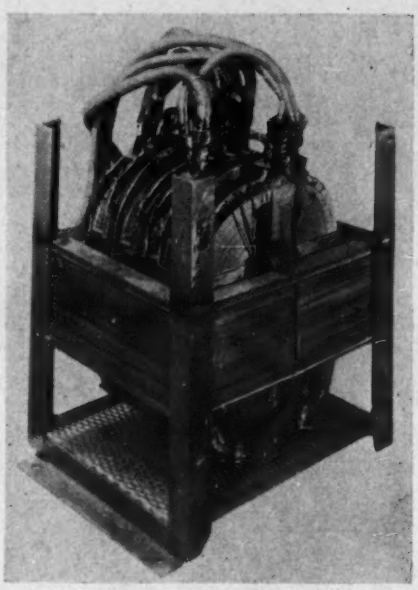


FIG. 2—Core and coil construction of redesigned dry-type natural-draft transformer

Units for wall mounting (Fig. 1), 1 to 10 kva., single-phase, and 3 to 25 kva., three-phase, are constructed with the lead compartment in the lower end of the case—the compartment is accessible through a removal cover. Standard concentric conduit knockouts are provided in the bottom, sides and back for line and load connections.

For use on the floor, 15 to 200 kva., single-phase, and 37½ to 300 kva., three-phase units have the lead compartment in the upper part of the case. Here again a removable cover on the compartment provides accessibility. Line and load leads are brought in through standard concentric conduit knockouts on each end. Single-phase ratings of 50 kva. and larger have terminal boards—as do all three-phase models.

Designed for standard voltages up through 5,000 volts, in single-phase units rated 200 kva. and below—also in three-phase units 300 kva. and below—all sizes have sheet metal cases with suitable openings for ventilation. External surface temperatures are lower than those of the older 55 deg. C. rise designs.

• • •

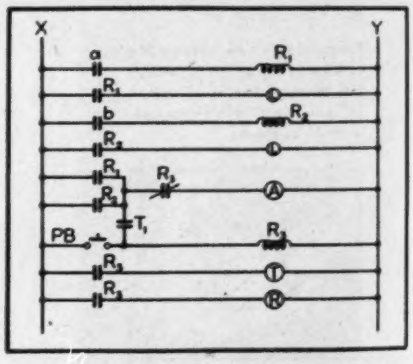
## Process Alarm With Spring Reset

By PAUL F. GREGG
*Electrical Engineer, H. K. Ferguson, Cleveland, Ohio*

An industrial alarm scheme, which has several applications, has been successfully used to indicate the temperature of a mixture of considerable volume, and to call the operator's attention to the process when certain prescribed conditions occur.

When a predetermined temperature is reached, "a" the temperature controller, closes its contacts thus energizing relay $R_1$. This closes contacts on $R_1$ lighting the indicating lamp L and sounding the alarm A.

This system up to this point is a simple annunciator and any number of devices similar to "a" may be connected in the same way. The operator, having been warned that the desired temperature has been reached, pushes momentary contact PB, thus energizing relay $R_3$ which silences the alarm by opening contacts $R_3$, starts timer T and lights trouble light R. When timer T starts, it immediately closes contact T in the sealing circuit for relay $R_3$. After three minutes (or any other predetermined time) the timer opens its contacts thereby deenergizing $R_3$. The alarm again sounds (assuming that the difficulties have not been rectified) and this cycle may be repeated at will. The timer is spring reset so that, if the trouble is cleared up during a cycle, everything returns to normal and processing proceeds.

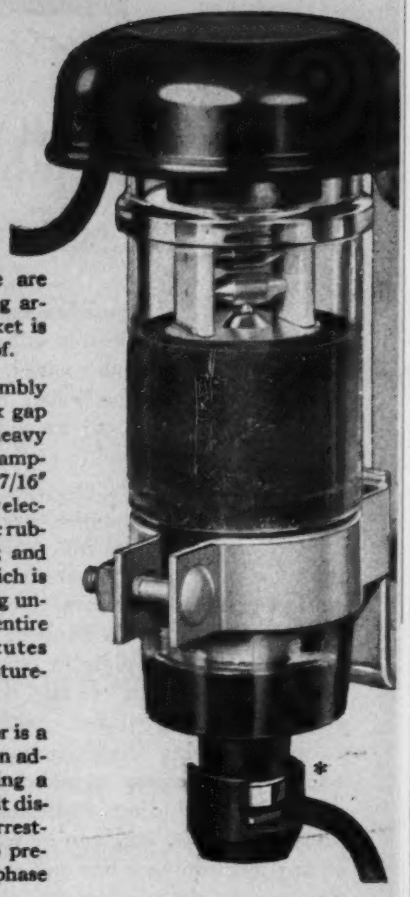



Devices "a" and "b" are operated by temperature, pressure, etc., or limit switch. $R_1$, $R_2$, midget relays with 2 N.O. circuits. $R_3$, midget relay with 2 N.O. and 1 N.O. circuits. PB, momentary contact. $T_1$, contact closed when timer (T) starts, opens after 3 minutes. L, indicating lamp. A, alarm

# It's the Way They're Made!

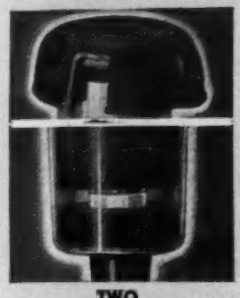
## That's Why L-M Lightning Arresters Provide Better Protection . . . Require Less Replacement . . . Lower Arrester Costs

The protection a lightning arrester will provide . . . the years over which it will handle light and heavy surges depend upon the way it is designed and built....L-M Lightning Arresters are outstanding in this respect. Failures in the field are negligible. Their ability to stand up for years means less expense for you.



### NO OTHER ARRESTER CONSTRUCTION LIKE THIS

ONE

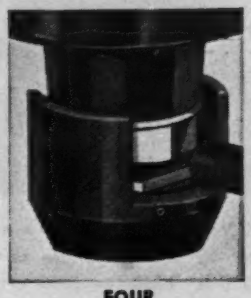


TWO

**1.** This illustration shows the glass housing with the characteristic element *molded* into the glass, not just poured or placed in. The copper contact surface, also illustrated, is applied in the molten state under pressure and becomes an integral part of the characteristic element. Due to war, porcelain housings are being temporarily used for part of our production.

**2.** In addition to the employment of 4 separate gaskets, L-M Lightning Arresters are further sealed with a strong, weatherproof sealing compound which completely seals in both the top and bottom of arrester. Two separate tests for moisture are made. No lightning arrester on the market is more moistureproof.

THREE



FOUR

**3.** This shows assembly of the ladder spark gap which is made of heavy brass bar—not stampings—machined to 7/16" diameter; the upper electrode; the synthetic rubber sealing gasket; and the copper cap which is spun to the housing under pressure. This entire assembly constitutes one compact moistureproof unit.

**4.** The L-M Isolator is a patented feature. In addition to identifying a damaged arrester, it disconnects a faulty arrester from the line to prevent grounding of phase or circuit.

Study the design and construction of L-M Lightning Arresters. Talk to the Line Material man. Ask him questions. Send for Bulletin 40151 for more detailed explanation than this advertisement contains. A little thought and investigation on your part will bring you to the conclusion that you can save your company a consistent amount of money over the years by standardizing on L-M Lightning Arresters. Line Material Company, Milwaukee, Wis.

***THE ISOLATOR**
**AN EXCLUSIVE L-M FEATURE**
**PAT. NO. 2,315,320**

**MEETS THE NEW NEMA STANDARDS**

These three Oscillogram photos show how L-M Lightning Arresters meet the new NEMA standards. Fig. 1 shows operation characteristics before 5,000 ampere operating cycle test of a 3 Kv Arrester. Fig. 2 shows characteristics after the 30th shot. Fig. 3 shows the unchanged characteristics after single 65,000 ampere surge as required by new NEMA standards.

Fig. 1 Fig. 2 Fig. 3

**SIZES**—L-M Lightning Arresters are made in 6 sizes with ratings ranging from 1 to 15 Kv.

**STANDARDS**—All L-M Lightning Arresters meet the new NEMA standards. In repeated tests L-M Lightning Arresters maintain uniform performance characteristics.

LM

# LINE MATERIAL

## LIGHTNING ARRESTERS

L-M DISTRIBUTION EQUIPMENT INCLUDES: Distribution Transformers · Fuse Cutouts and Fuse Links · Lightning Arre
Oil Switches · Pole Line Hardware · Line Construction Specialties · Underground Equipment · Fibre Conduit · Street Lighting Equip

# LOAD SERVICING

Commercial
Industrial

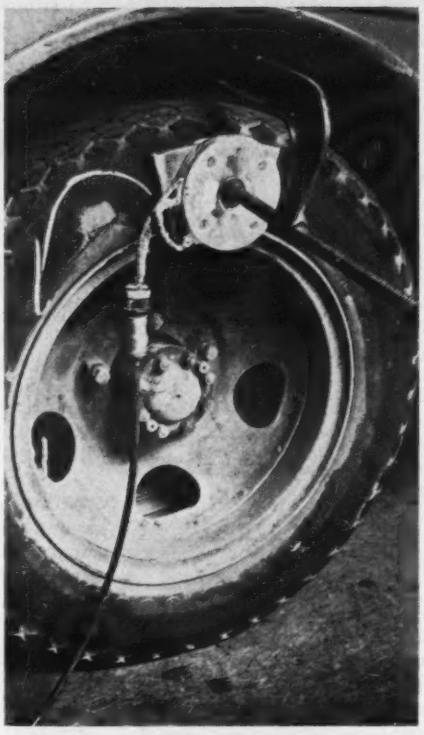
Residential
Rural

## On-Wheel Repair Saves Time and Tires

By R. J. OWEN
*Department of Automotive, Pacific Gas & Electric Co., San Francisco, Calif.*

A method of vulcanizing damaged automobile and truck tires without removing them from the wheel which was developed by the writer is now being successfully used to speed up service and other operations throughout the P.G.&E. system. The small portable vulcanizer shown consists of an electrically heated hot plate with thermostatic control, two removable contact plates that conform to tire surface when pressure is applied, and a clamp to hold the plate in place and apply pressure. An electric drill, a small rotary file, rubber cement and rubber stripping stock complete the equipment necessary to make repairs.

Cracks, including radial cracks, abrasions, holes, etc., can be repaired in any location on a tire and covering any reasonable area on any size tire with the following limitations: on four-ply tires, one ply broken or cut; on six-ply tires, two plys broken or cut and on eight- and ten-ply tires, four plys broken or cut.



**EXTENSIVELY damaged tires are quickly repaired "on the wheel" by use of a "C" clamp which is used to hold portable vulcanizer and apply pressure. Curved contact plate and side wall plate make the portable vulcanizer applicable to all sizes of passenger and truck tires**

The method of making repairs is as follows: remove all loose dirt and foreign matter in and around injury; cut away all loose rubber and fabric with knife; cut sides of hole to approximately 45 deg. with surface of tire; roughen surface of cut with rotary file; set pressure at 40 lb. (all sizes); cover entire surface of hole with rubber cement and allow approximately five minutes drying time, or until cement is no longer fluid; fill hole with rubber stripping stock ($\frac{1}{16}$ in. thick) level with surface of tire; after vulcanizer has been allowed to heat up to operating temperature (15 min.) clamp in place over stripping stock, using contact plate on side wall, and plate only, on tread; allow twelve minutes heating time for each $\frac{1}{16}$ in. in depth of stripping stock used; remove vulcanizer and repair is complete; cut tread design in repairs of large area.

The heating element consists of a 4-in., 400-watt, 115-volt, Chromolox heating unit, with a Chromolox thermostat. The heating unit is mounted in an aluminum shell with a removable shoe plate. A receptacle on the back of the aluminum shell takes the large "C" clamp for holding the vulcanizer in place and applying the pressure on the tire.

This is a preventative tire maintenance device which saves man-hours by permitting repairs to be made without removing the tire from the vehicle. Moreover, repairs can be so easily and quickly made that there is no excuse for permitting cuts, cracks, holes and abrasions to do permanent damage to the much needed tires.

•

## REA Recommendations for Chick Brooders

Based on plans submitted by agricultural colleges in 22 states, the technical standards division of REA has issued the following recommendations for construction of indoor electric chick brooders:

1. Sizes:

   For 50-100 chicks, 36 inches square, four 50-watt Mazda or equivalent lamps

   For 100-150 chicks, 42 inches square, four 100-watt Mazda or equivalent lamps

   For 150-250 chicks, 48 inches square, four 150-watt R-40 lamps

   For 250-350 chicks, 48 inches wide, 72 inches long, four 200-watt R-40 lamps

2. Area per chick: A minimum of nine square inches per chick should be provided for each size brooder.

3. Wattage per chick: A minimum of 2.0 watts per chick should be provided, based upon maximum brooder capacity.

4. Ambient Temperature Variation: Size of lamps may be varied depending on heat requirement.

5. Temperature Control: Two lamps on opposite sides of the brooder shall be controlled by a thermostat and the other two wired for continuous operation.

6. Heat Source: For the smaller sizes, 115-volt Mazda lamps or equivalent are used as the source of heat. For the larger sizes, R-40 lamps or equivalent are recommended. They may be projector floods, reflector floods, or drying lamps of 150-, 200-, or 250-watts each. Only lamps having at least a 1,000-hour life should be used.

7. Thermostat: A thermostatic switch of the wafer-type or equivalent should be provided. This switch should be capable of controlling incandescent lamp loads. It should be placed so as to maintain the temperature near the controlled lamp within a range of 5 deg. F.

8. Curtain: A curtain should be

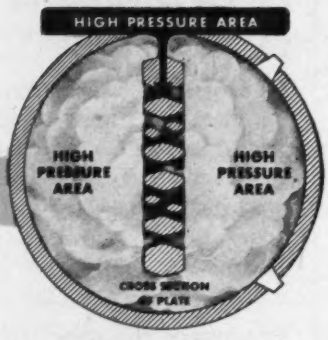
# *Only* PHILCO FLOTÉ BATTERIES

## give you this dependability, low-cost maintenance and long life

PHILCO FLOTÉ BATTERY TYPE 9 DF

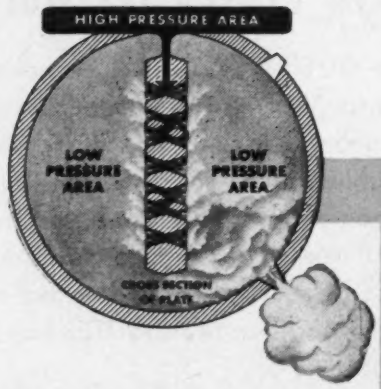
WITH the famous Philco Floté element—the only battery construction specifically designed for full float service—low cells are eliminated. High capacity, superior conductivity and efficient current distribution are assured. It is a known fact that the special metal in which Floté grids are cast reduces the amount of current needed to maintain the charge by 40%! And the less current your stationary batteries require to maintain their charge, the longer service life you get. Philco Floté grid design is today's answer to dependable service and long life. For control and stand-by service, Philco Floté Batteries in Steel Glass jars are available in cell capacities from 10 A.H. to 1056 A.H. Write for Control and Auxiliary Power Battery catalog.

PHILCO CORPORATION, STORAGE BATTERY DIVISION
TRENTON 7, NEW JERSEY




## *FAMOUS "K" PROCESS*

**produces plates far superior in hardness, porosity, durability**




1. Plates packed with active material (Flake Oxide) are hung in the chamber of the "K" Dehydrator. Super-heated steam is introduced and sealed into the chamber so that it surrounds all surfaces of each plate uniformly, creating a high pressure area around the active material in the plate. The steam also permeates the active material until the pressure within the plate equals that of the steam in the chamber. The moisture within the active material is also changed to steam during this part of the process.

2. Steam is released from the chamber, restoring the low pressure area around the plate. The steam pressure within the plate then forces the active material firmly and evenly against the grid members, assuring greater *conductivity*. As the steam which has permeated the active material escapes, it forms large numbers of tiny channels from the center to the surface of the plate, creating exceptional *porosity*. Drying has been uniform, which prevents surface cracking and assures equal consistency throughout the plate.

Guth

*In 1942--We Introduced*

# QUICK-LITER*

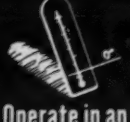
## *The Original Starterless* FLUORESCENT!

**No Starter Switches**
Maintenance cost is lower, and the problem of checking for "dead" Starters is eliminated.

**Lights Instantly**
At the flick of the switch—there's light! No flickering, flashing, or waiting.

**Long Lamp Life**
QUICK-LITER gets maximum usage from lamps.

**Operates at Irregular or Low Voltage**
QUICK-LITER *starts and operates* at as low as 85 Volts.



**Would Operate in an Ice Box**
QUICK-LITERS *start and operate* as low as 0° F. Temperature. Many are now in use in Alaska and the Aleutians.

**Immediately Available**
QUICK-LITERS can be shipped at once on AA-5, or AA-2-MRO, or higher priorities.

## Two Years of Rigid Testing Have Proved Its Worth!

The GUTH QUICK-LITER was originated for War Plants; where high maintenance costs due to Starter-Switch troubles, and variable line-voltage conditions, made *Starterless* Fluorescent desirable. Detailed performance records were maintained, so that every claim made for QUICK-LITER has been *proved* by use.

***A valuable report on the results of these tests is now available. Write for your copy today.***

Guth *QUICK-LITER
TRADE MARK

The Edwin F. Guth Co. • 2615 Washington Ave. • St. Louis 3, Mo.

provided on all four sides. It must be hemmed on the bottom edge.

9. Hover Construction:
   (a) The design should follow the general pattern of the brooder developed by Ohio State University. This provides for a flat roof with the sides of the brooder extending at least four inches above it to allow for litter insulation. The same design and overall dimensions will apply if manufactured as a stamped metal product. Note: A non-combustible insulating material should be used, if available.
   (b) All material used in the construction of the brooder should be of sufficient size and strength to provide for sturdiness and long life.
   (c) Adjustable legs should be provided to allow for changing the height of the opening. An alternate method, such as a rope, pulley and counterweight may be used.
   (d) All wood and other materials, when necessary, must be protected by a suitable paint or other finish.

10. Brooder Cord: The brooder cord shall be heavy duty rubber-covered Type SJ with at least Number 16 size wire or PWP-32 for war emergency. WPB order R-1 amended June 1, 1943.

11. Underwriters' Approval: All electrical parts must be of a type approved by the Underwriters' Laboratories and all wiring installations must conform to the National Electrical Code.

•

## Progress Report* on Post-War Load Survey

In order to arrive at a determination of their probable post-war electricity requirements, the Philadelphia Electric Co. is making a survey of customers. Certain data from the survey have been compiled, among them the following information on 9,689 small commercial and industrial users of energy:

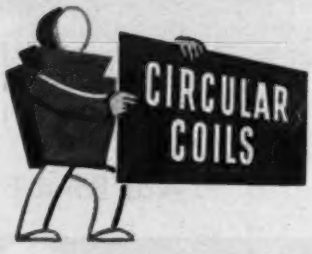
* From paper by J. F. Gaskill to Missouri Valley Electric Association. Other excerpts will follow in later issues of Electrical World.

# Transformer Fundamentals

## ...that insure unfailing power supply to *war industries.*

*The fundamental improvements outlined below are the result of Pennsylvania's continuous research and development to assure greater transformer reliability, lower operating costs and longer life! They are but a few of the many improvements to be found in Pennsylvania Transformers.*

23,500 KVA
55°, 115 KV
3-phase




### . . . Possess Maximum Inherent Strength

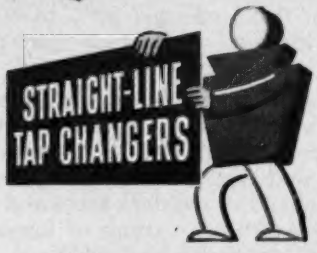
In a circular coil the tension of each turn of wire is uniform throughout its length. No coil of any other shape possesses this quality.

The turns in a circular coil are wound tightly without excessive tension on the wire —thus eliminating the possibility of stretching the winding and injuring the insulation. This added safety is inherent in Pennsylvania's circular coil construction.

### . . . to withstand short circuits

All coils of the helical and pancake type are precompressed to such an extent that no further compression can take place under the most severe short circuit. This definitely precludes any possibility of the coil stack moving or distorting under short circuit.

The ability of the coil to maintain its shape under the prescribed pressure is your guarantee that the transformer will withstand short circuits.




### . . . with Silver-to-Silver Contacts

Pennsylvania's straight line tap changer with its silver-to-silver contacts is capable of carrying heavy overloads without overheating and is able to withstand "dead" short circuits without detrimental effects.

Tests have been made to fully prove these characteristics, the tap changer being subjected to 100,000 full operations—more than would occur during the normal life of the transformer.

Pennsylvania TRANSFORMERS

**Pennsylvania TRANSFORMER COMPANY**

808 RIDGE AVENUE, • N. S., PITTSBURGH, PA.

# FLOORS that SALVAGE LIGHT

**Light-Reflecting Floors made with Atlas White cement help make lighting systems more effective**

We buy light to make seeing easier; yet much of its effectiveness is wasted by dark colored floors, just as by dark walls and ceilings.

Floors made with Atlas *White* cement, instead of gray cement, salvage light rather than absorb it. This is shown by lighting tests in a large airplane plant where the white cement floor reflected 20% to 60% more light to work areas than did an adjacent gray cement floor.

White concrete floors further promote ease of seeing by reducing the contrast in brightness between work areas and surroundings. They cut down shadows and dark areas and reduce eyestrain—a cause of lowered production, waste and accidents.

Whether in conversion or new construction, light-reflecting floors can help make lighting more effective. Send for the booklet, "Light from Floors," containing test data, cost and recommended installation and maintenance practice. Write: Atlas White Bureau, Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Chrysler Building, New York 17, N. Y.

**HOW ABOUT MAINTENANCE?**

Experience shows white cement floors are easy to clean, easy to keep clean, and retain their reflection advantage. Maintenance is simple—frequent sweeping, occasional damp mopping, periodic scrubbing.

EW-F-28

**ATLAS WHITE CEMENT**
For Light-Reflecting Floors


The effect of the war on the businesses of these customers was helpful in 2,740 cases (30 percent) and hurtful in 6,618 (70 percent)

Lighting intensity is under ten footcandles in 7,548 cases (80 percent) and over ten in 1,941 (20 percent)

Practically all customers (97 percent) observing war time lighting restrictions will return to normal usage.

It is figured that these 9,689 customers now need additional service totalling:

3,759.1 kw. for lighting
1,031.9 kw. for exterior signs
121.3 kw. for interior signs
522.1 kw. for ventilation
472.3 kw. for air conditioning
195.2 kw. for refrigeration
452.9 kw. for heating
1,884.1 kw. for cooking

•

## 2,387 Customers Made Happy By Swap Plan

Through the Swap Plan almost 5 percent of the 49,000 residential customers of the Pennsylvania Power Co. were spared the loss of service of electric appliances.

All who participated have been benefited by the plan. Persons trading their appliances received in payment $13,069 in war savings stamps. Uncle Sam received the loan of this money to fight the war. In 7½ months dealers enjoyed almost $42,000 of business that otherwise they would not have had. Ultimate purchasers have had their needed appliances again. And the company maintained that load on its lines.

Company's own activity in the plan began in July, 1943. All dealers were given the opportunity to become part of the plan. Eighteen dealers throughout the territory actively engaged in it. Through personal contacts and a series of bulletins, dealers were made acquainted with the project.

Opening gun was a large advertisement appearing in the papers July 20, 1943. Since that time a consistent schedule has been maintained—a total of 1,857 inches of newspaper space has been used. In addition the story was repeated on the company's radio broadcast, the "Town Crier" program. Dealers identified their participation with window signs and display, counter cards, and a distribution of circulars. Public response to these efforts has been gratifying and is indicated in the accompanying list of Swap items totalling 2,387 appliances.

**Appliances Reclaimed and Sold**

| Item | Number |
|---|---|
| Irons | 842 |
| Radios | 271 |
| Toasters | 196 |
| Cleaners | 171 |
| Radio Tubes | 150 |
| Washers | 135 |
| Motors | 112 |
| Refrigerators | 89 |
| Percolators | 70 |
| Waffle Irons | 60 |
| Clocks | 60 |
| Heaters | 49 |
| Hot Plates | 41 |
| Grills | 35 |
| Lamps | 30 |
| Fans | 22 |
| Mixers | 18 |
| Ironers | 7 |
| Record Players | 6 |
| Shavers | 4 |
| Roasters | 2 |
| Miscellaneous | 22 |
| Total | 2,387 |

After 6½ months the returns began to dwindle. Most of the obsolete appliances have been restored to use. However there are probably many old or "broken" appliances still on the shelves, in cellars, attics and garages of the customers' homes. The company is not closing the books on the Swap Plan until it has exhausted every means of bringing these into service and thereby patriotically assisting in the redistribution of appliances.

•

## Utility Pushes War Bond Drive

"Yuh mean there's a WAR on!"

GEORGIA POWER COMPANY
A CITIZEN WHEREVER WE SERVE

**THIS ADVERTISEMENT was published in the Atlanta Journal of Labor as a part of Georgia Power's promotion of the Fifth War Loan**

# MORE POWER TO YOU

## Through Anaconda Copper Bus Conductors

COPPER HAS ALWAYS been the most widely used material for bus conductors. In addition to the basic requirement of high conductivity and consequent low current losses, copper provides high thermal conductivity, high strength and high resistance to corrosion. Accessory equipment is readily available.

And Anaconda Copper Bus Conductors are available in shapes to meet every power transmission requirement:

***Flat Bars,*** requiring minimum space, may be bent or twisted, connected to apparatus without special joint preparation, and in laminated construction have unlimited d.c. capacity.

***Tubes*** provide the highest bus conductor efficiency at a.c. frequencies, have greater rigidity, less surface area for dissipation of heat and may be oil or water cooled.

***Channels,*** with large surface area and ventilation feature reduce temperature rise, have greater rigidity for long runs than tubes, flat surfaces for tap-off.

***Angle Squares,*** ventilated hollow busses with highest rate of heat dissipation handle greater current density but require more space for installation.

***Cables*** solve many problems in conducting extremely heavy currents in confined space or in connecting moving apparatus such as arc or resistance furnaces.

Information, including our Bus Conductor Booklet C-25, and the advice of our Technical Department on various bus conductors and assemblies, is available on request. 44110

ANACONDA
from mine to consumer

*Anaconda Copper*

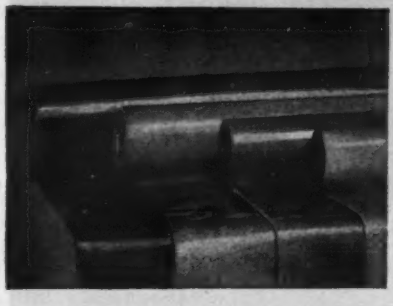
THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Connecticut

*Subsidiary of Anaconda Copper Mining Company—In Canada:* ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

# EMPIRE

## VARNISHED CLOTHS & TAPES

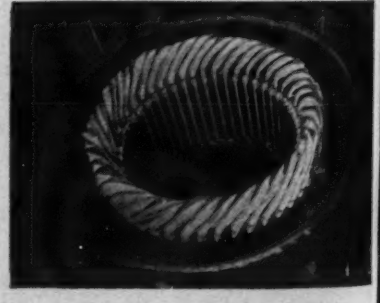
"EMPIRE," the oldest name in varnished cloth and paper insulation, symbolizes the fifty-year span of Mica Insulator Company's experience in manufacturing this highly specialized form of electrical insulation.



**EMPIRE CLOTHS** are carefully selected to facilitate impregnation, canvas and duck being used where greater thickness and higher mechanical strength are required; silk, rayon or fine cambric where insulating space is at a premium. EMPIRE varnishes are especially formulated under laboratory supervision for specific uses, and are chosen for their ability to penetrate the base material and provide a smooth surface.

**EMPIRE BIAS-CUT TAPES** have elongation properties not possessed by standard straight-cut tape. They are ideal for application to conductors and coils, conforming more readily to irregular surface. Extra stretch avoids the coning effect produced when wrapped helically. Available in yellow (suitable for continuous oil immersion,) or black (for higher dielectric strength).

**EMPIRE VARNISHED FIBERGLAS,** in both full-width cloths and in straight-cut tapes, is impregnated with either yellow or black varnish to provide a highly flexible, mechanically strong class "B" insulation, permitted to withstand a "hottest spot" temperature of 266° F. May be slit into any tape width specified by the customer. An ideal slot insulating material for use in the presence of humidity, oil, grease, dirt and frequency of overload.



## BRANCH OFFICES

*For convenient and expert service, call upon the Mica Insulator Company representative at the following branch office addresses.*

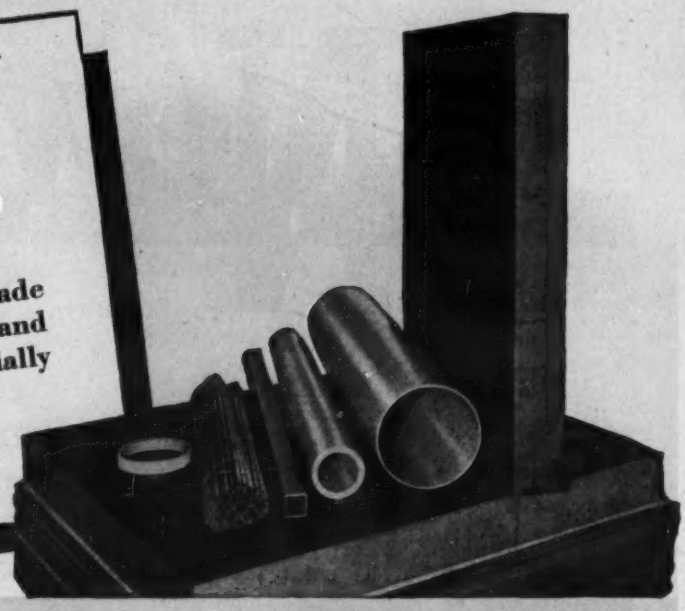
**Chicago: 600 West Van Buren Street • Cleveland: 1276 West 3rd Street • Detroit: Book Building • Cincinnati: 3403 Hazelwood Avenue • San Francisco: 235-241 San Bruno Avenue • Seattle: 2122 Fourth Avenue • Los Angeles: 449 South San Pedro Street**

**MICA**

# LAMICOID

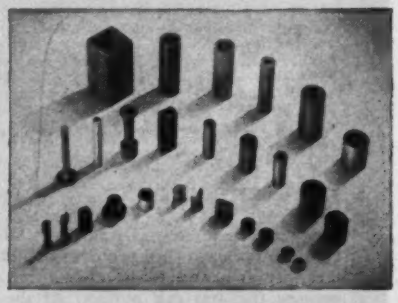
## LAMINATED PLASTIC

**LAMICOID sheets, rods and tubes—made from a variety of paper, cloth, asbestos and Fiberglas bases, are bonded with especially selected thermo-setting resins to meet special requirements.**



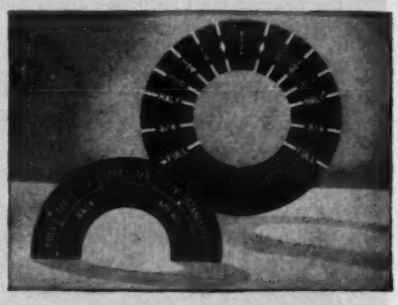
**MECHANICAL LAMICOID** offers high mechanical strength, dimensional stability and resistance to moisture and shock. Strong, dense and nonhygroscopic, it is easily punched, sheared, sawed or machined into intricate shapes. Available in rods and tubes with a wide range of diameters, and in sheets (36 x 42 standard size) in all thicknesses.

**ELECTRICAL LAMICOID** is manufactured particularly for applications requiring low power factors and low dielectric loss at high frequency ranges. Widely used in the manufacture of insulating components in the electrical manufacturing and electronic fields, it is suitable for both high and low voltage uses.



**ENGRAVING LAMICOID**—A combination sandwich-type opaque laminated sheet which permits pantograph engraving or sandblasting. Also furnished in translucent form for uses requiring "rear" illumination of dial, signs or indicia. Ideal for uses requiring small quantities.

Fabrication facilities for all types of electrical, mechanical and engraving LAMICOID applications are available through our fabricators at the addresses below:



## FABRICATORS

**Mica Insulator Company, 200 Varick Street, New York 14, N. Y. Insulating Fabricators, Inc., 12 East 12th Street, New York 3, N. Y. • Insulating Fabricators of New England, Inc., 22 Elkins St., S. Boston 27, Mass. • Lamicoid Fabricators, Inc., 3600 Potomac Avenue, Chicago 51, Illinois • The Kirby Company, 13000 Athens Avenue, Cleveland 7, Ohio**

# INSULATOR COMPANY

**200 VARICK STREET, NEW YORK 14, N. Y.**

# NEW EQUIPMENT

Model 2-B Electronic Power Generator: power output 2000 watts—6,800 B.t.u./hr. (max.); power input 4.5 kw. (approx.); line voltage 220 v., 50-60 cycle, single phase; frequency 27.4 mc.; wt. 750 lbs.; dimensions 48 in. high x 30 in. wide x 25 in. deep; tubes, oscillators 2-RCA 833A, rectifiers 4-RCA 8008, control 2-RCA 2050. **Radio Corp. of America**, Camden, N. J.

## HF Generator

A high-frequency generator in which the operator places the preformed charge on the bottom heater plate, closes the lid, and presses the starting button. At the end of the heating cycle, a preset timer automatically shuts off the current and opens the lid. Is said to heat up to one pound of moulding material per minute. Doors of the cabinet on which pictured unit sets has automatic disconnect switch as safety feature.

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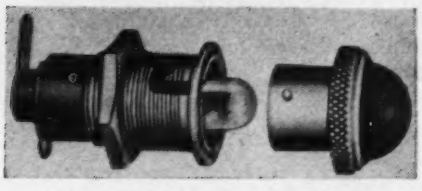


T3 BLC Unit: single hole; bayonet type lamp bulb; lens-cap. **H. R. Kirkland Co.**, Morristown, N. J.

## Pilot Light

For use with T3 type single-contact bayonet lamp bulb and embodies a new design of lamp socket. Said to be free from pressfit methods of assembly and providing a direct electrical connection from the shell and center contact pin to the terminal spades.

## Magnet Wire

Formex ribbon-rectangular magnet wire: thickness 0.004 in. **General Electric Co.**, Schenectady, N. Y.

Formex wire developed for strength, flexibility and smoothness necessary for high-speed winding and to improve winding space factors.

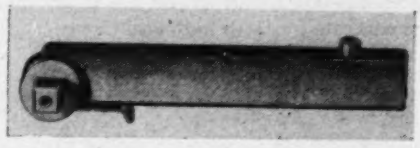
•

## Current Transformer

Type NAS indoor current transformer: current ratios 200/5, 400/5, and 600/5; 1,000 v. maximum; burden up to 25 volt amp. **Standard Transformer Co.**, Warren, Ohio.

Current transformer designed to meet wide range of application in the field of low voltage measurement. Easily discernible polarity markings, similar primary mounting dimensions on all three ratios, mechanical connector type primary potential terminal, secondary short circuiting device and tamper-proof sealing facilities.

•



Socket Drive model wrench: torque tolerances of 2% + or —; torque setting range 8 to 750 inch pounds. **Richmont, Inc.**, 215 W. 7th St., Los Angeles 14, Calif.

## Wrench

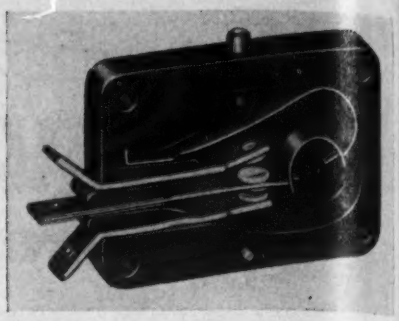
Set and sealed at the torque specified by the buyer, the socket wrench gives both audible and physical signal when that load is reached. Uses a lock connection adaptable to various heads, extensions, crowsfeet. The working member is concentric with the rocker-pin so that the torque cannot be influenced by the operator.

•

## Insulating Varnish

Type R-851—Clear baking insulating varnish: bakes dry at 135 deg. C. **Sterling Varnish Co.**, 127 Ohio River Blvd., Haysville, Pittsburgh, Pa.

An insulating varnish reported to be flexible when dried and therefore applicable to lead wires. Also stated to be water, acid and alkali resistant and usable on glass covered wire designed to operate at high operating temperatures.



"Miniac" snap-switch: 15 amp., 115 volts, a.c.; single pole, normally open or normally closed, double throw; dimensions, 17/64-in. thick, 13/16-in. high, 1 13/16-in. long. **Acro Electric Co.**, 1340 Superior Ave., Cleveland 14, Ohio

## Snap-Switch

Bakelite-enclosed, miniature switch is designed to permit leaf type or overtravel plunger type actuators to be attached to the case. Contacts are of silver. Main blade, contact blade and rolling spring are made of beryllium copper.

•

"Sure-Shift" Interconnector: Size 2 in. **Industrial Interconnector Co.**, 2150 Niagara St., Buffalo 7, N. Y.

## Water Interconnector

Water-supply interconnector is a hydraulic valving mechanism designed to deliver water from either of two inlets to a common outlet. If the hydrostatic pressure prevailing in the customarily used inlet falls below a predetermined value (approximately 20 psi.) the water supply is automatically shifted to the stand-by source. Upon resumption of natural pressure conditions, supply connections shift back to the original position. The shift-over is completed in approximately 15 seconds depending upon the water pressures. This action protects compressors, condensers and other equipment requiring uninterrupted supply of cooling water. It is stated no dangerous cross connection betwen public and private systems is possible.

•

## Barometric Draft Control

Barometric draft control; aluminum vane; turn-weight counterbalanced; pipe sizes 4 to 6 in. **Perfex Corp.**, Milwaukee, Wis.

An aluminum barometric draft control vane with spring steel hinge pivot; said to assure permanent calibration after initial setting since it eliminates the bearing hinge pivot. The vane with its off-center weight can be installed in either vertical or horizontal pipe.

**BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.**

# Infra-Red Radiant Heating Equipment ... Engineered for Efficiency

*Illustrated: A portable batch oven of 18 kilowatts capacity for baking electrical motors and motor parts. The installation as pictured above permitted Benjamin's For Motors, Brooklyn, N. Y. to triple its motor baking capacity.*

★

• C. M. Hall Lamp Company has engineered practical innovations in the field of infra-red radiant heating which have become standard in the design of infra-red ovens as a production tool. Among such advances are:

COMPLETELY ENCLOSED OVENS PERMITTING FULLEST USE OF HEAT — BOTH RADIANT AND DERIVED CONVECTED HEAT, ASSURING BETTER TEMPERATURE CONTROL

PREFABRICATED PANEL CONSTRUCTION — SIMPLIFYING ERECTION AND REDUCING OVERALL COST.

REMOVAL OF ALL VITAL PARTS (WIRING, LAMP BASES, AND SOCKETS) FROM THE HEAT ZONE TO OUTSIDE THE OVEN WALL.

POSITIVE VENTILATION CONTROL THROUGH THE USE OF EITHER A RECIRCULATION OR AN EXHAUST SYSTEM.

**These exclusive Hall features are built into infra-red equipment employing radiant heat sources varying from 250 watts to 1000 watts.**

• **C. M. HALL LAMP COMPANY INVITES YOUR QUESTIONS AS TO HOW INFRA-RED RADIANT HEATING EQUIPMENT CAN SOLVE YOUR HEATING PROBLEM**

INSTANT

**C.M. HALL LAMP CO.**

HEAT

1035 EAST HANCOCK ST. DETROIT 7, MICHIGAN

**COME TO THE PLANT THAT SPECIALIZES ON THEM... *and nothing else***

The Harper organization devotes its energies and facilities exclusively to non-ferrous and stainless fastenings. It manufactures bolts, nuts, screws, washers, rivets and specials of Brass, Bronze, Copper, Everdur, Monel Metal and Stainless Steel. It produces nothing in common steel or iron.

Harper offers large and widely assorted stocks ... extensive manufacturing facilities ... engineering "know-how" ... a special order department ... and field service difficult to match elsewhere. All of which means much to the fastening user.

New four color, one hundred four page catalog and valuable reference book ready soon.

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EVERLASTING FASTENINGS
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**BRASS • BRONZE • COPPER • EVERDUR • MONEL • STAINLESS**

## TECHNICAL LITERATURE

**Combustion Control**—An electrical-balance system of combustion control for various fuel-fired boilers in smaller industrial and municipal power plants is outlined and illustrated in "Combustion Control, Type P, for Boiler Furnaces," Cat. N-01P-163, obtainable from Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia 44, Pa.

**Metals**—"The Technical Editor Speaks" is a handy reference which explains the practical meanings of technical words that are used in describing and measuring the mechanical properties of metals and alloys, also contains numerous definitions, a glossary and cross references. The 24-page booklet is available from International Nickel Co., Inc., 67 Wall St., New York 5, N. Y.

**Rolling Doors**—Construction of metal and wood rolling doors and grills, selection of fire doors and shutters, types of drives and methods for mounting motor-drive units are outlined in Bulletin No. 39 obtainable from Kinnear Manufacturing Co., 820 Fields Ave., Columbus, Ohio.

**Wood**—Circular calculator has two adjustable dials to convert linear to board feet, determine slope per foot in degrees, find comparative hardness, weights, shrinkage, warping and ease of working of various woods. Bit sizes for screws, nail specifications and tips on tool sharpening are also included on the 6-in. diameter calculator obtainable for 10 cents from Greenlee Tool Co., Rockford, Ill.

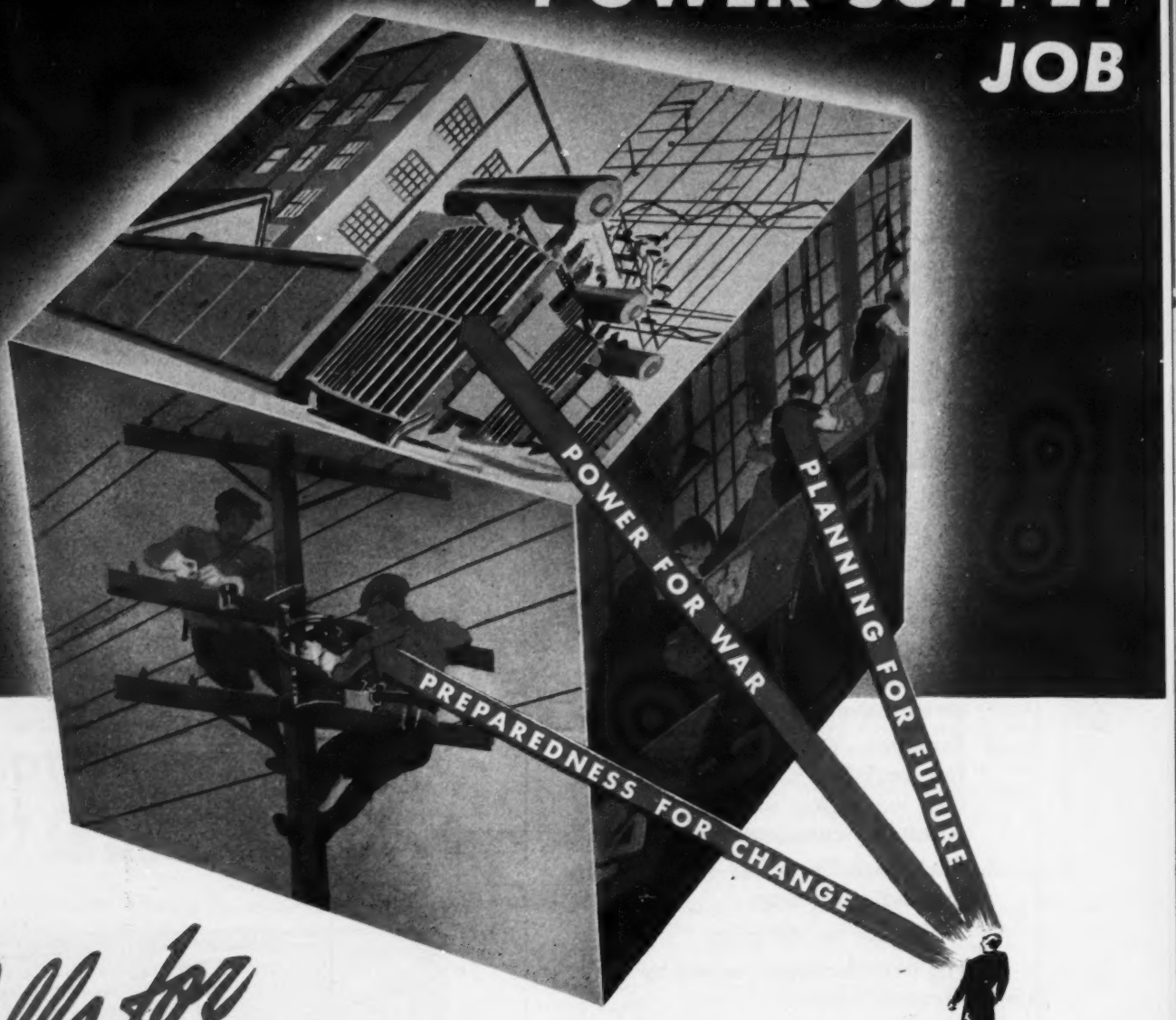
**Flow Meters**—A 32-page booklet, "A New Era in Flow Rate Measurement" contains schematic diagrams of applications of Rotameters, a list of fluids handled, explains how the area-type flow meter functions, and how it can be used for variations in viscosity and specific gravity. It is obtainable from Fischer & Porter Co., 9122 County Line Road, Hatboro, Pa.

**"Symposium** on the Identification of Water-Formed Deposits, Scales, and Corrosion Products by Physico-Chemical Methods," is a 44-page booklet containing an introduction describing the use of physico-chemical methods for identification purposes, three technical papers—X-ray Diffraction Methods in the Study of Power Plant Deposits, Diagnosis of Water Problems at Limbo Station, and The Interpretation of Analyses and Problems Encountered in Water Deposits—and a general discussion. Copies of the booklet may be obtained from American Society for Testing Materials Headquarters, 260 S. Broad St., Philadelphia 2, Pa., at 65 cents each.

**Temperature Calculator**—Designed for determining the welding preheating and interpass temperatures of steels. It is 6¼ inches in diameter and consists of four movable sections of heavy cardboard stock. Complete instructions in the form of six simple steps are printed on the outside sections. The calculator is available through The Lincoln Electric Co., Cleveland, Ohio; price 25 cents, postpaid, anywhere in the United States.

**Standards**—"American Standard Terminal Markings for Electrical Apparatus," Publication C6.1–1944. Price $1. American Standards Association, 29 West 39th St., New York 18, N. Y. Sponsored by N.E.M.A., connections and markings are listed for rotor rotation, connection diagrams, rotating apparatus; constant-potential, instrument and constant-current transformers; feeder voltage regulators; industrial control; current-limiting reactors; attachment plugs; and electric water heaters.

# TODAY'S 3 DIMENSIONAL POWER-SUPPLY JOB




## Calls for THREEFOLD SERVICE

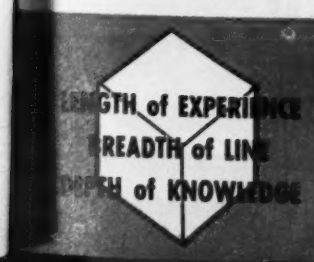
*Power production and distribution to war industry* remains the first concern of the electric power and light industry. Though the danger of a production-crippling power famine has been averted, unparalleled load-peaks may still have to be met.

But today's job can't end with today's kva. As war needs alter and changeovers occur, shifts in power demand are sure to be needed. New loads at new locations require *preparedness now!*

At the same time, every decision, every purchase, must be considered from still a third angle — the *long-term plans* for after Victory, when the utility industry will be expected to be ready for higher *electrical* standards of living.

Between these three jobs, there is no dividing line — they are an interrelated problem — a single task with three dimensions.

*To increase your effectiveness* on each phase of the problem, your GRAYBAR Representatives, backed by leading suppliers, are ready with a three-fold service of supply. It includes emergency service for war-essential maintenance, preparedness on supplies for fast alterations and replacement, and a foresighted appreciation of your long-range needs.




# GraybaR

IN OVER 80 PRINCIPAL CITIES

# FOR YOUR PRESENT AND CHANGE-OVER HOOK-UPS

**Advantages of**
**T&B LOCK-TITE**
**Pressure (solderless)**
**Connectors**

1. Ease of installation. Key wrench or screw driver. No solder.
2. Economy. You need stock only a few Lock-Tite Connectors because they lug or tap any kind of cable, in various combinations.
3. Each Lock-Tite takes several overlapping cable sizes.
4. Resistance to vibration.
5. High conductivity insured by direct pressure contact.
6. Resistance to heat. Lock-Tite Connectors run cooler than the cable itself.
7. High pull out value.
8. 100% salvage value.
9. Underwriters' Laboratories Approvals.

Phone your T & B Electrical Wholesaler for these versatile

## T&B LOCK-TITE PRESSURE CONNECTORS

A small stock is all you need to lug or tap any kind of cable up to #1,000,000 CM.

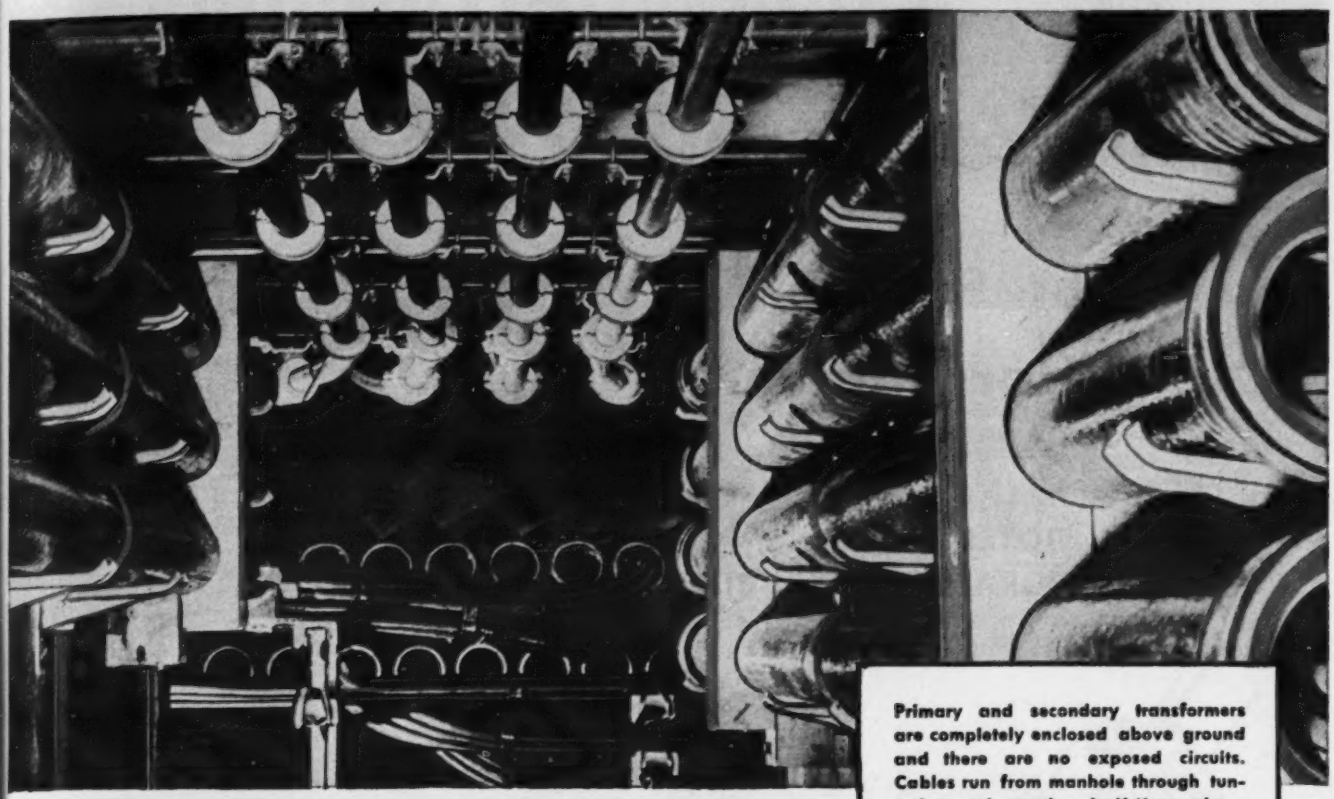
***Write today to Dept. EW-6 for T & B Maintenance and Repair Booklet giving the practical information you want.***

T&B

**THE THOMAS & BETTS CO.**
INCORPORATED
**manufacturers of electrical fittings since 1899**
ELIZABETH, 1, NEW JERSEY
In Canada: Thomas & Betts Ltd. Montreal

TODAY'S 3 DIMENSIONAL POWER-SUPPLY JO

# GIVING CABLE THE VITAL PROTECTION IT NEEDS FOR WAR AND PEACE



Primary and secondary transformers are completely enclosed above ground and there are no exposed circuits. Cables run from manhole through tunnel to sub-station building where switches and instruments are located. On sides of tunnel ORANGEBURG FIBRE CONDUIT with bell ends is used to house and protect the cables.

**Orangeburg Conduit offers 8 important advantages to America's electrical industry as it faces the tremendous task of supplying power and light to a nation geared to peak war production today—and planning to meet even greater demands that will come with the peacetime future of tomorrow.**

1. **LESS CABLE PULLING TENSION.** Orangeburg's low coefficient of friction keeps it to a minimum.

2. **LESS CABLE SHEATH ABRASION.** Orangeburg's smooth inner surface does not score or damage the cable sheath as it is being pulled into the duct, or as it creeps with load changes.

3. **LESS GROUND WATER INFILTRATION.** With its tight taper sleeve joints and impermeable walls, Orangeburg Conduit prevents entry of ground water.

4. **PERMANENT—NON-CORRODIBLE—NON-CORROSIVE.** Over 50 years' service shows that once installed, Orangeburg Conduit is good for many decades. The non-corrodible material is not disintegrated or destroyed by the action of ground waters or chemical wastes. Orangeburg's cellulose fibre and coal tar pitch composition is non-corrosive to cable sheath.

5. **ECONOMY OF INSTALLATION.** Orangeburg Electrical Conduit is low in first cost, low in transportation and installation costs.

6. **EASE OF INSTALLATION—VERSATILITY.** Orangeburg Conduit is light in weight, easy to handle, easy to saw, easy to lay. Joints can be quickly made on the job. The taper sleeve coupling assembles speedily to produce a watertight joint without the use of compounds. No special tools necessary. Changes of direction easily made.

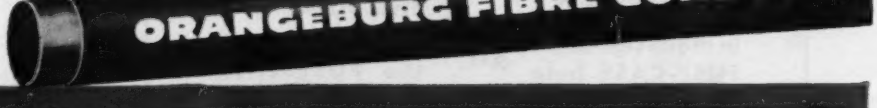
7. **SERVICE FITTINGS AVAILABLE.** Orangeburg helps to prevent costly delays in the field and makes every job satisfactory from start to finish by supplying bends of various radius and degree, angle couplings, expansion joints, union connections, bell ends and other standard fittings to handle any unexpected conditions that may crop up during construction.

8. **DEVELOPMENT—PROGRESS.** The period from 1893 to 1944 has been one of continuous Orangeburg pioneering and progress in fibre conduit design and workmanship and lowered cost to the user.

ORANGEBURG STANDARD
for installation with concrete encasement

•

ORANGEBURG NOCRETE
for installation without concrete encasement




THE FIBRE CONDUIT CO. ORANGEBURG, N.Y.

**ORANGEBURG**

WITH 50 YEARS EXPERIENCE IN THE MANUFACTURE OF NON-METALLIC CONDUIT AND PIPE, SERVES THE POWER AND LIGHT, TELEPHONE, GENERAL CONSTRUCTION, CHEMICAL, PETROLEUM, PLUMBING AND BUILDING SUPPLY FIELDS WITH ELECTRICAL FIBRE CONDUIT . . . ELECTRICAL UNDERFLOOR DUCT SYSTEMS . . . AND FIBRE PIPE FOR NON-PRESSURE USES.

CALLS FOR *Threefold* SERVICE

Via GraybaR

# "We Wiped Out Repeated Production Interruptions When We Installed BUSS FUSES

## ...in the Switch Controlling Our 5-Horsepower Grinders"

*Says* A. L. GROFFMANN, CHIEF ELECTRICIAN DOYLE MACHINE AND TOOL CORPORATION, SYRACUSE, NEW YORK

"OUR battery of 5-hp. grinders is controlled by a 100 ampere fused switch.

"When several of the machines are started simultaneously, such as when the whistle blows after the lunch hour, a heavy current surge results. This momentary overload repeatedly caused the fuses in the switch to blow and shut down the whole battery of grinders.

"In November, 1943, we installed BUSS Super-Lag fuses in the switch and since that time we haven't had a single shutdown on that important circuit."

**Why BUSS Fuses Don't Blow Needlessly**

**10 FEATURES** in the design of the FUSE-CASE help make it possible. *and* **THE SUPER-LAG** development in the FUSE-LINK completes the job.

**BUSS Super-Lag**

TODAY'S 3 DIMENSIONAL POWER-SUPPLY

*Here is the Steel Products Grinding Department at Doyle Machine and Tool Corporation. A shutdown here stops production and makes operators stand idle—but overhead and wages continue to pile up.*

*Drill Department. Another spot where a useless shutdown can be very costly in lost production, wasted man-hours, and needless overall expense.*

Here is another outstanding example that demonstrates how Buss Super-Lag fuses are helping to keep production running smoothly, how they reduce lost man-hours, and save trouble and grief for electricians and maintenance men.

If you have a problem similar to the one at Doyle Machine and Tool Corporation, doesn't this example indicate how you can profit by the use of Buss Super-Lag fuses?

Buss fuses require no maintenance or periodic inspection. They don't open needlessly. If one opens, you can be sure some condition needs correction. When one opens, it requires less than 45 seconds to renew with an inexpensive link.

### Why BUSS Fuses greatly reduce or entirely prevent needless blows

The fuse case is designed to insure good contact on the link, even when the fuse is renewed by an inexperienced person—and it is so designed that vibration or heavy overloads or the constant heating and cooling of the fuse will not permit poor contact to develop. Thus excessive heating, which causes fuses to blow needlessly, is prevented.

The fuse link used is the famous "BUSS Super-Lag." It has lag-plates attached to it. These give it a long time-lag so that unusually heavy starting current or other harmless overloads will not cause the fuse to blow.

### Prevent future trouble in your plant—by doing this today

Pass the word along that all purchase records dealing with circuit protective devices should be immediately changed to call for BUSS Super-Lag Renewable fuses. Then, as fuses are replaced or new installations made, your plant will automatically get the benefit of the carefree, trouble-proof protection that BUSS Super-Lag fuses afford.

BUSSMANN MFG. CO., St. Louis 7, Mo.
*Division McGraw Electric Company*

**FUSES** Sold Through Wholesalers

CALLS FOR *Threefold* SERVICE Via GraybaR

# *Together*... YOU AND WE WILL

## THE NEXT CHALLENGE

The Electrical Industry in the past 3 years has put forth its greatest effort of all time, resulting in a record of accomplishment to carry down through the years. With Victory, we shall face a great challenge—that of Peace.

Production in 1942 of 189 billion kilowatt hours of electrical power, to arm America, was made possible in only one way. It required the many-sided and wholehearted cooperation between every unit of the Electrical Industry, Utilities, Electrical Contractors, Electrical Manufacturers, and the Electrical Wholesalers.

*Because their efforts were* <u>united</u>, *not a single war plant has been delayed for lack of electrical power.*

The lessons learned in these 3 years will not be forgotten in the days to come. When America can turn to the task of supplying the needs of a world at peace, at price levels which will assure the employment of America's millions, the Electrical Industry will approach that task with confidence... *together.*

GENERAL C

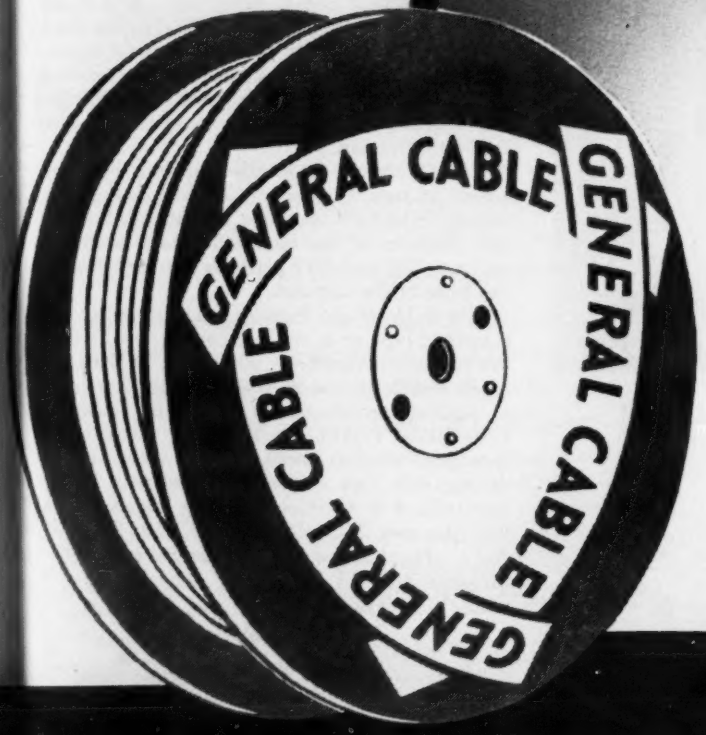
TODAY'S 3 DIMENSIONAL POWER-SUPPLY JO

# MEET TOO . . .

*General Cable* has right along paid tribute to the magnificent efficiency of our friends, the Electrical Wholesalers. Without the countless hours they have saved all of our hard-pressed industries, the accomplishments of these war years would have been impossible.

Under the necessary system of priorities, they have often had to wait for some urgent government need to precede theirs. We pledge them that our unceasing efforts are today directed towards making available at the earliest possible moment the many advances born under the impetus of war-time research. Meanwhile — as witness our recently announced policy of shipping reels, spools, and containers on a "no charge" basis — General Cable's objective continues to be . . . to now take every step possible, consistent with winning the war, that may shorten the conflict and assist its wholesalers to better meet the peace to come.

Graybar — you are our friend — and we are yours. We salute you!




CABLE CORPORATION

CALLS FOR *Threefold* SERVICE

Via GraybaR

# Designed for SAFETY

## *in dust-laden atmospheres*

Carbon black, coal dust, coke dust and grain dust are hazards. To guard against dust explosions which may be set off by exposed arcs,

*This Power Plant of a large New England utility company (not identified for obvious reasons) is equipped with FA Dust-tight Circuit Breaker Panelboards in all hazardous locations.*

## DUST-TIGHT Light and Power PANELBOARDS

were expressly designed. They are proving vital protection in shell-loading plants, coal mines, coal processing plants, grain mills and other places where dust is dangerous. They are approved by Underwriters' Laboratories, Inc., for "Class II, Groups F and G, Hazardous Locations."

Instead of the usual steel front with door, these panelboards have a solid steel front plate, gasketed all 'round and secured with screws to the extra wide box flange. They are further rendered dust-tight with welded hubs for conduit outlets, welded box-corners, and handle bushings riveted directly to the steel cover plate. External mounting brackets are provided to maintain the dust-tight construction.

The circuits are externally operable by a mechanism of new FA design. The handles operate through dust-tight bushings, and engage the regular handles of the circuit breakers inside the cabinet. ON and OFF positions are indicated on the front of the cabinet.

The FA Dust-tight Panelboard may be had in standard type or in narrow column type. It is of the circuit breaker type, with either FA Type AC or FA Dublbrak circuit breakers (or other types of lighting branch-circuit circuit breakers)... Capacities: Lighting Panels — 50 amperes or less, for 3 wire, single phase, or 4 wire, 3 phase mains, with lugs only or main breaker. Available with 4 to 42 circuits. Power Panels—50 to 600 amperes, 250 volts AC or DC, and 600 volts AC... Frank Adam Electric Company, Box 357, St. Louis, Mo.

*At left: Lighting Standard type FA Dust-tight Panelboard and Cabinet for wall or exposed column mounting. (12" or 15" wide, as required.)*

ESTABLISHED 1891 — THE SIGN OF A BETTER JOB

Frank Adam

ELECTRICAL PRODUCTS

FRANK ADAM ELECTRIC CO. ST. LOUIS, MO. U.S.A.

TODAY'S 3 DIMENSIONAL POWER-SUPPLY JOB

# FUTURE PLANNING THAT STARTED 82 YEARS AGO

## POWER FOR WAR

Helping to keep aloft the nation's power lines, vital to the Battle of Production, is but one of American Crossarm's present-day jobs. Beyond that, it has sent to the Fighting Fronts, all over the globe, over one million crossarms, almost ten million pins and brackets and numerous other staples and specialties. And it is prepared to do still more.

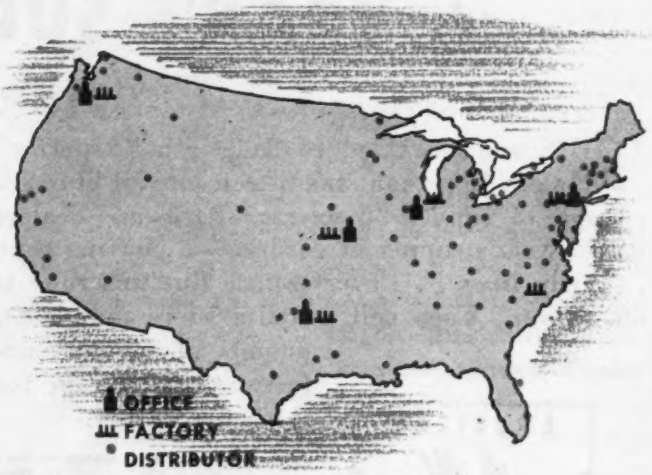
## PREPAREDNESS FOR PEACE

Long before the Boys come marching home, American Crossarm will be "reconverted", for we still are producing the things we have been making for more than 80 years. With equipment in good order, an organization that is well rounded and on its toes and with methods and knowledge further improved, the swing to peacetime production will involve little more than the writing of new shipping tags.

## PLANNING FOR THE FUTURE

America's postwar planning is simple... and sound ... involving but two steps: (1) To make the best product that can be made, and (2) to distribute it in the way that best serves the consumer's interests.

We confidently believe that in the Future, as in the long Past, the combination of American's manufacturing skill and Graybar's unexcelled national distributing facilities will spell Greater Satisfaction to the User, wherever he may be.




**GENERAL OFFICES**
22 W. Monroe Street,
Chicago, Illinois

**SALES OFFICES**
New York, N. Y.
Kansas City, Mo.
Chehalis, Washington
Texarkana, Texas

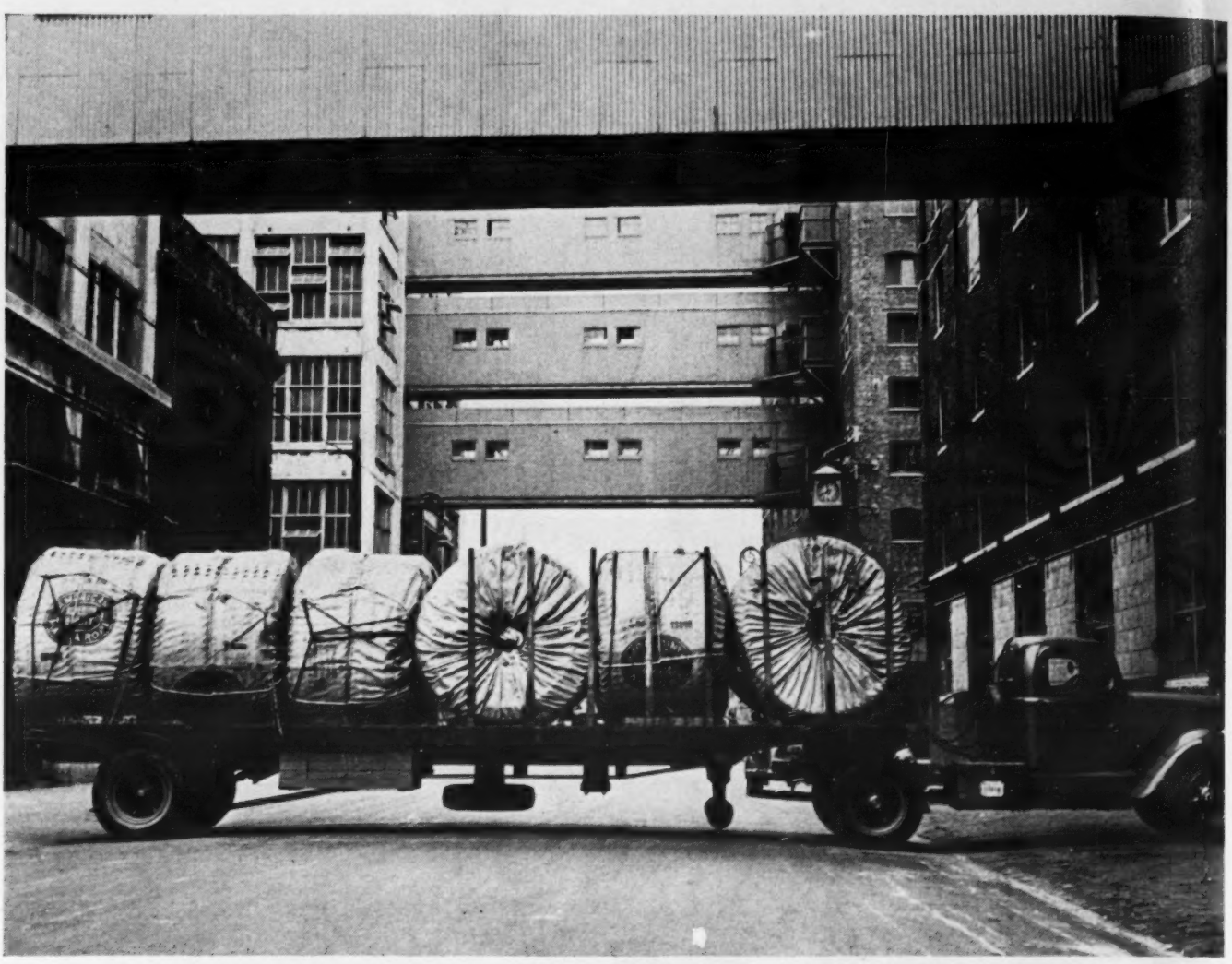
**AMERICAN · CROSSARM**
**AND CONDUIT COMPANY**

RAINIER WOOD PRODUCTS
TRADE MARK
FOR
OVERHEAD AND UNDERGROUND CONSTRUCTION

**FACTORIES**
Chehalis, Washington
Chicago, Illinois
Kansas City, Mo.
North Bergen, N. J.
Texarkana, Texas

CALLS FOR *Threefold* SERVICE

Via GraybaR



# A YEAR'S SUPPLY OF ROPE

## *that 38 dealers are doing without!*

THIS one truckload of American "Superior" Manila Rope contains fifteen tons of fibre . . . enough to supply 38 average hardware dealers with a year's supply of cordage . . . haying rope . . . trip lines . . . everything. But this rope is off to war. Each coil contains more than 5000 pounds of 12" circumference manila rope for ships for victory.

All the fine manila ropes you bought from American Manufacturing Company before the war — "Amco" All-weather Treated — American "Superior"—"Clipper"—"Pennant" — are now vital war materials. We are doing our best to fill the gaps in your jobber's stocks with good substitutes and we are making these substitutes to the very highest standards possible. You can buy them with confidence. See your jobber.

*Back up the Rope Conservation Campaign sponsored by the cordage industry. Write for free booklet "14 Ways To Make Rope Last Longer" and other material.*

AMERICAN

MAKES GOOD ROPE

# AMERICAN ROPE

TWINE • OAKUM • PACKING

AMERICAN MANUFACTURING COMPANY, Noble and West Sts., Brooklyn 22, N. Y. *Western Factory:* ST. LOUIS CORDAGE MILLS, St. Louis 4, Mo.
*Sales Offices:* Baltimore, Boston, Chicago, Houston, New Orleans, Philadelphia

TODAY'S 3 DIMENSIONAL POWER-SUPPLY JO

# REDUCE INVENTORY

with

## ARMSTRONG'S

## universal distribution type insulator

HERE'S a universal-type insulator that combines three conventional-type designs in one. It's Armstrong's No. 512U—for use in place of side-groove, top-groove, and double-groove insulators. This interchangeability of No. 512U enables you to reduce your inventory, providing a substantial saving in money and space.

The double-groove feature of No. 512U makes it adaptable for breaking a series street-lighting circuit at a lamp cut-in.

The top groove and upper side groove accommodate conductors up to the diameter of 4/0 tree wire. The lower side groove takes conductors up to the equivalent size of No. 4 tree wire.

Armstrong's No. 512U meets all the specifications for low- and medium-voltage pin-type lime-glass insulators set up by the Joint Edison Electric Institute and Glass Manufacturers Committee.

### Complete line of communication and signal insulators

Armstrong manufactures also a complete line of communication and signal insulators—including many designs that are now standard with America's leading railroads, telegraph systems, and telephone companies. Like Armstrong's No. 512U, these insulators are made of uniform, crystal-clear glass. They always fit snugly on pins, because they have improved thread design and accurate pin cavities. And their resistance to thermal shock, proved in test and in the field, assures you that all the Armstrong's Glass Insulators you buy will withstand all weather conditions.

**ARMSTRONG'S**

**"WHITALL TATUM" GLASS INSULATORS**

**FREE SAMPLES**—Your local Graybar representative will be glad to supply you with complete information, samples, and prices of Armstrong's Glass Insulators. Write or telephone him today. Armstrong Cork Company, Industrial Division, 295 Fifth Avenue, New York 16, N. Y.

CALLS FOR Threefold SERVICE

Via GraybaR

# *This Head and Yours should get Together*

# NOW

*Subjects:* **Increasing Production**
**Conserving Manpower**
**Reconversion Planning**

Available to you now are the services of Lighting Specialists, not only for recommendations on the improvement of existing lighting to meet immediate needs, but also in connection with your *reconversion planning.*

First step in such planning is a study of each specific location and the kind of work involved. With the Seeing Task thus determined, plans can be formulated as to the amount of light and type of lighting which are needed to provide the most efficient seeing.

In determining how much light and the type of lighting that are required, the Lighting Specialist will take into consideration: the *size of detail* to be seen; the *contrast* between the object being worked on and the surroundings; the *brightness* of the object; the *speed of seeing* required; and, the *duration* of the visual task. Further, he will suggest ways of eliminating annoying glare, sharp contrasts and harsh shadows; prescribe proper lighting units to distribute and direct the light where most needed.

By calling upon your local Electrical Wholesaler who distributes Benjamin Lighting Equipment or upon your local Light and Power Company, the services of a Lighting Specialist may be obtained without cost or obligation. Available through them, also, is the assistance of Benjamin field engineers, when such are needed, for lighting recommendations and specifications.

Many manufacturers now engaged in reconversion planning are utilizing the aid and assistance of their local Lighting Specialists. For lighting is a production tool that goes hand in hand with all other production tools . . . and should be considered concurrently.

**BENJAMIN**
TRADE MARK
*Lighting Equipment*
Distributed Exclusively Through Electrical Wholesalers

*Send for a copy of this FREE BOOKLET containing much valuable information on how to obtain best lighting results. With it will be sent complete information on how you may obtain the assistance of the Benjamin Field Engineer in analyzing the performance of your lighting and in making recommendations. Address Lighting Service, Benjamin Electric Mfg. Co., Dept. K, Des Plaines, Illinois.*

# MOVE OR ADD LIGHTS WITHOUT REWIRING—WITH UNIVERSAL Trol-E-Duct

BullDog's Universal Trol-E-Duct installation in a large midwestern machine tool plant. Note how the closely spaced fluorescent fixtures are suspended and tap current from the Trol-E-Duct runs.

## 4 BIG HELPS TO PRODUCTION

### 1 Puts Lights Where They Are Needed—Close to the Work

Universal Trol-E-Duct is a job-proven, modern refinement in factory lighting. Every inch of the duct is a potential electrical outlet which can be instantly tapped to put light close to the work. Simply move the light along the overhead duct, or plug in new lights wherever needed.

### 2 Always Ready for Quick Production Changes

Universal Trol-E-Duct, built in standard sections, is quickly and easily installed, and can be moved as easily to another location. It is an extremely flexible system — 100% salvable — always ready for quick production changes.

### 3 Fits Any Production Set-Up

It can be mounted against the ceiling or suspended by messenger cable below it. It will fit the layout of any industrial plant or commercial building.

### 4 Accomodates Any Type of Lighting Fixture

No matter what type of lighting fixture you use — fluorescent, mercury vapor, or incandescent — Universal Trol-E-Duct can accommodate it because every unit of the system is pre-fabricated at the factory for a wide variety of lighting fixtures.

*Extreme Left* — Shows how simply the trolley may be inserted at the end of the duct runs. Trolley entrance couplings also make possible insertion of trolleys between sections.

*Immediate Left*—The Twistout Plug can be used at any point in the duct run simply by inserting it in the duct slot and giving it a 90 degree turn.

BullDog Universal Trol-E-Duct is a lighting system of assembled standard duct sections, tightly and safely enclosing copper bus bars from which trolleys and twistout plugs collect current.

Thousands of war plants, big and small, find this thoroughly modern lighting system an important factor in speeding production by bringing light close to the work.

If conditions do not permit you to change over to this easy, quick, flexible lighting system now, be sure to modernize with Universal Trol-E-Duct before the products of peace go to market again.

***Buy More War Bonds — Turn in Your Scrap***

**BULLDOG**

**ELECTRIC PRODUCTS CO.**

BOX 177, R. PK. ANNEX
DETROIT 32, MICHIGAN

BullDog Electric Products of Canada, Ltd., Toronto, Ont.

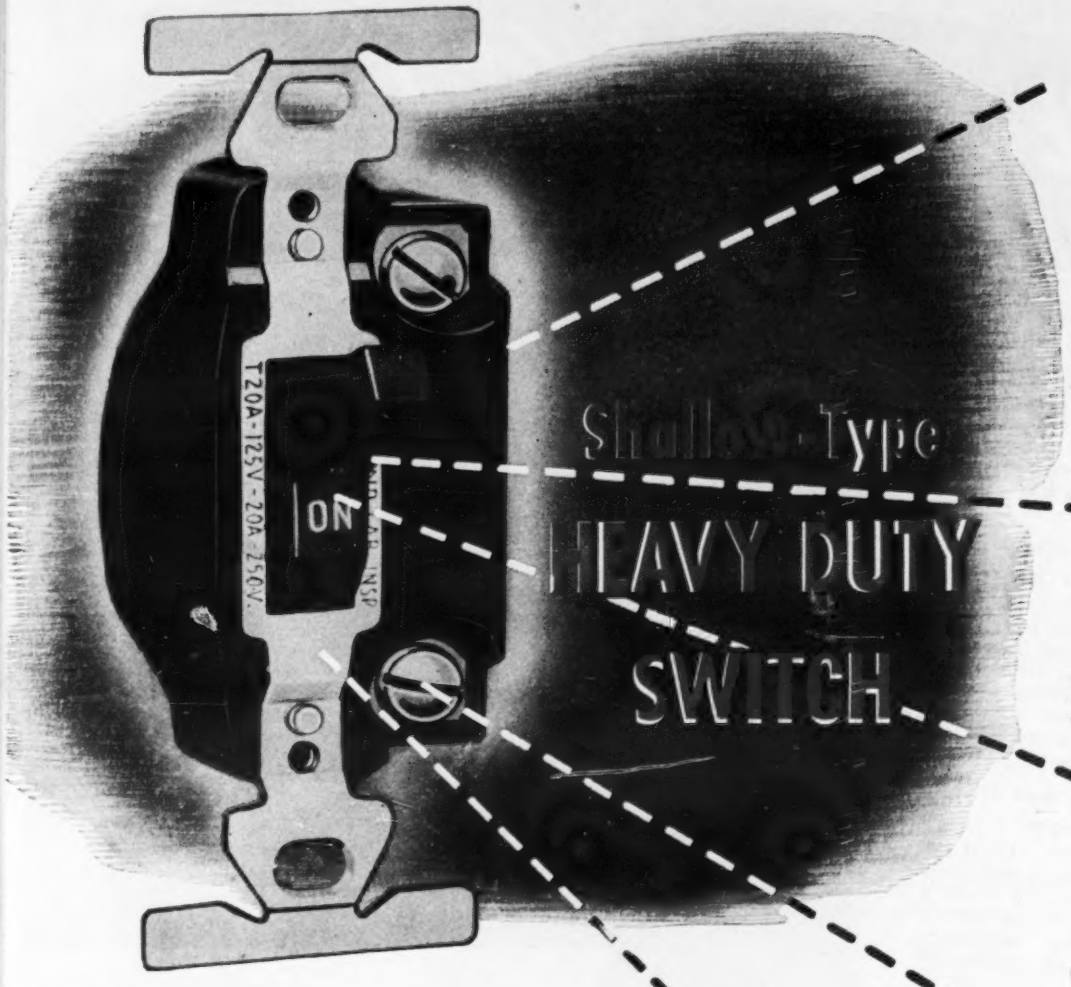
Field Engineering Offices in All Principal Cities

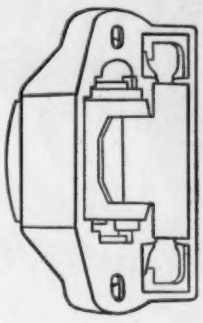
**ALSO MANUFACTURERS OF**

VACU-BREAK SAFETY SWITCHES • SAFTOFUSE PANELBOARDS • SWITCHBOARDS • CIRCUIT MASTER BREAKERS • BUSTRIBUTION DUCT *for "Plug-in" power* • INDUSTRIAL TROL-E-DUCT, *for movable "loads."*

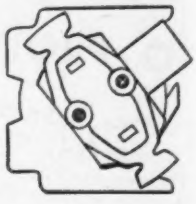
CALLS FOR *Threefold* SERVICE

*Via* GraybaR



**BAKELITE CASING** fully encloses mechanism. Extra thick walls survive handling impacts and exclude dust and dirt.

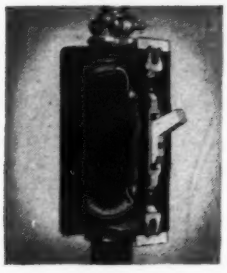


**RUGGED MECHANISM** of heavy-gauge metals withstands repeated use and abuse, assures trouble-free operation.

**HEAVY SPRING** of carefully tested spring wire assures positive switch action for tens of thousands of cycles.

**POSITIVE CONTACT** provided by doubled-sided blades of selected spring bronze, shaped and adjusted to "make" and "break" contacts simultaneously.

**STURDY YOKE** has integral plaster ears for aligning flush with wall, or easily broken off if not needed. Completely insulated from mechanism.



**SHALLOW DESIGN** *permits installation in 1½ inch deep box, with adequate space for easy wiring*

The Bryant 5861 switch is "T" rated at 20 amperes, built to carry the heaviest demands of the rated load. Every part in the switch is made of the strongest materials available, assuring you of a shallow-type switch capable of withstanding tough service. Note the details of Bryant construction and design as shown here.

BRYANT
SUPERIOR WIRING DEVICES

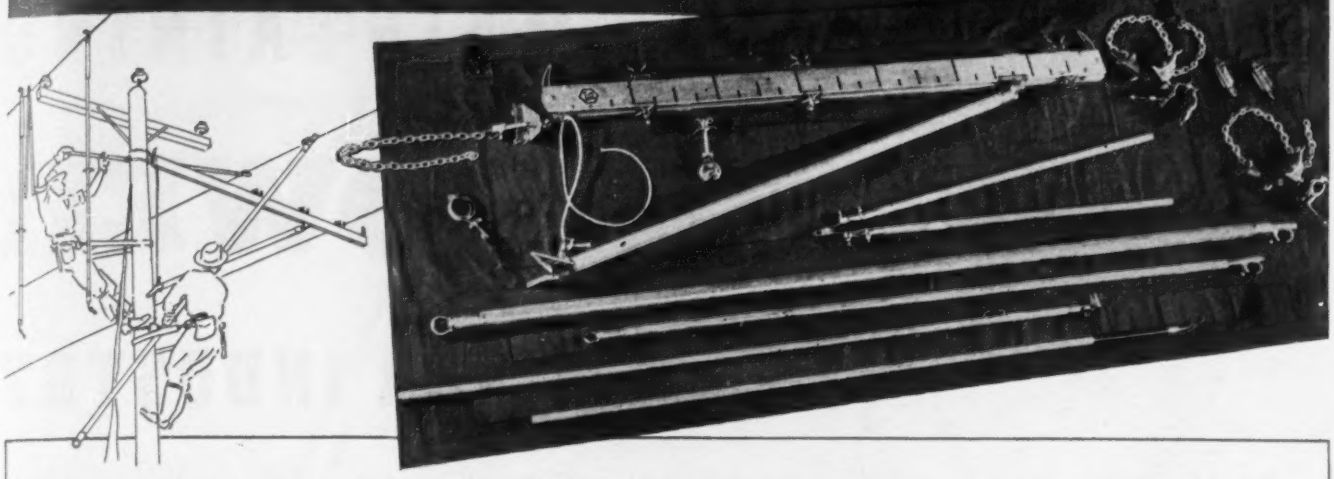
*Specify Bryant Devices from your Electrical Wholesaler*

**THE BRYANT ELECTRIC COMPANY**
**BRIDGEPORT, CONNECTICUT**

NEW YORK
CHICAGO
SAN FRANCISCO
LOS ANGELES

**TODAY'S 3 DIMENSIONAL POWER-SUPPLY JO**

# Chance Construction and Maintenance Equipment is available through Graybar without excessive delay . .



## TIPS TOOL SET NO. 4800-10 HANDLES MANY HOT LINE JOBS

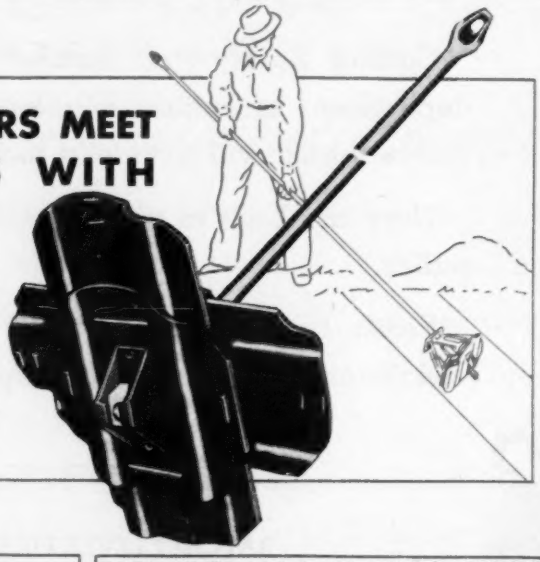
This Tips Tool set, No. 4800-10, gives you the minimum essentials for doing hot line repair work on straight line construction up to 15 KV. It may be used in a variety of ways to do a variety of jobs. The auxiliary arm may be used as a side arm or as a lifting arm in combination with the wire tongs. The wire tongs may be used together for lifting a single conductor into the clear or one tong may be used to make a straight lift.

With this set of tools a maintenance crew can remove or replace poles, cross arms, insulators, etc., in complete safety without interrupting service. It is the first step toward outfitting maintenance crews with complete equipment for handling all maintenance work hot. Additional tools may be added as the requirements demand. Many services do not require more than the few essentials shown in this inexpensive set of Tips Tools.

## CHANCE STEEL EXPANDING ANCHORS MEET MOST GUYING REQUIREMENTS WITH HOLDING POWER TO SPARE

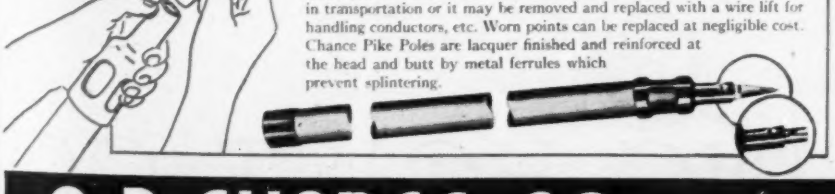
Because of their efficient performance under so many different soil and guying conditions, Chance steel expanding anchors have for years been the favorite of many public utilities throughout the United States; and today, they are used extensively by the Army, Navy, and Army Signal Corps throughout the world.

Chance all-steel anchors are built to stand abuse. They are practically unbreakable. They are built to do the job with power to spare. Blades expand at right angles equalizing strain at all points. The nut retainer prevents the anchor from riding up the rod during installation and permits salvaging the rod or driving it down in case the anchor is to be abandoned.



## CHANCE SAFETY PIKE POLES HAVE WIRE LIFT ATTACHMENT

The point on Chance Pike Poles may be removed and reversed for safety in transportation or it may be removed and replaced with a wire lift for handling conductors, etc. Worn points can be replaced at negligible cost. Chance Pike Poles are lacquer finished and reinforced at the head and butt by metal ferrules which prevent splintering.



## TIPS HOT TAP CLAMPS MAKE 3-POINT CONTACTS

Tips Hot Tap Clamps are made to contact the conductor at three points. The U S S Threads permit quick, easy application and a tight, positive grip with minimized danger of sticking due to corrosion. Made in all sizes and types for making hot line connections without interrupting service.

**A·B·CHANCE CO·**
**CENTRALIA, MISSOURI.**

ABC A.B. Chance Industries

**CONSULT OUR CATALOG OR ASK THE GRAYBAR MAN**

CALLS FOR *Threefold* SERVICE

Via GraybaR

# SAFETY-PULL

## MAINTAINING POWER FOR INDUSTRY

Coffing Safety Pull Ratchet Lever hoists will assist your maintenance department in cutting minutes from "time *down*", for repairs and maintenance which will save you many production hours.

They are built to operate either end up or laying down—as a hoist or puller.

Easily carried and operated by one man. Model A-G-¾ ton illustrated, weighs only 14 pounds. Factory tested at 100% over rated capacity.

*Write today for catalog E G-6 illustrating the Coffing electrical maintenance tools*

RATCHET LEVER PULLERS — TRANSFORMER GINS — TEMPORARY CROSS ARMS — LOAD BINDERS — POWER PIKE POLES — FLAG and FLAG HOLDERS — TEMPORARY GUY CLAMPS

# COFFING HOIST CO.

DANVILLE, ILLINOIS

TODAY'S 3 DIMENSIONAL POWER-SUPPLY JO

# The Curtis SKYLUX

*featuring...*

**SCIENTIFIC SHIELDING AND HIGH LIGHT OUTPUT**

## *for two 40-watt Fluorescent Lamps*

A revision of the priorities regulations permit us to again offer the famous Curtis SkyLux, with steel reflectors, baked snow-white Fluracite reflecting surfaces and Satin Gray enameled shields and molding.

The high efficiency of this unit, combined with scientific shielding, has made it the outstanding two-lamp fixture on the market. The SkyLux shield prevents a direct view of the lamp from ordinary angles and at the same time the inner surface of Fluracite serves as a reflector to direct the light downward. This is accomplished without trapping light and no horizontal surfaces are present to collect dust.

The SkyLux principle results in high initial light output which is maintained with little depreciation throughout the long life of the fixture.

**CURTIS *Lighting*, INC.**

6135 WEST 65TH STREET, CHICAGO 38, ILLINOIS

CALLS FOR *Threefold* SERVICE

*Via* GraybaR

# BACK AGAIN

## POPULAR "DAY-LINE" INDUSTRIAL FIXTURES

## *Again Available with Porcelain Enamel Reflectors*

**HEAVY-DUTY RLM DAY-LINE** — always the favorite because they combine the ultimate in lighting efficiency with quick installation "ICE-TONG" hangers, low-cost maintenance and easy accessibility.

The RLM DAY-LINE
Single unit, for two or three 40-watt or two 100-watt lamps.
Bulletin F-77.

The RLM DAY-LINE
Continuous runs, for two or three 40-watt or two 100-watt lamps.
Bulletin F-77.

### DAY-LINE
### "W" and "WS" Series with "Snap-on" Reflectors



The "W" Series — non-metallic reflectors with Day-Brite's exclusive "Super-White" enamel . . . The "WS" Series — porcelain enamel reflectors . . . Both types available for single-unit installation in two 40-watt, three 40-watt and two 100-watt models . . . Bulletin F-76.

### GET FULL INFORMATION

Contact your local Day-Brite engineering representative or write for the Bulletins which contain complete, valuable information fully describing and illustrating both continuous and unit mounting Day-Line Fixtures—including dimensions, mounting diagrams, photometric data, weights and prices.

**DAY-BRITE LIGHTING, INCORPORATED**
5490 Bulwer Avenue — St. Louis 7, Missouri

Day Brite LIGHTING FIXTURES

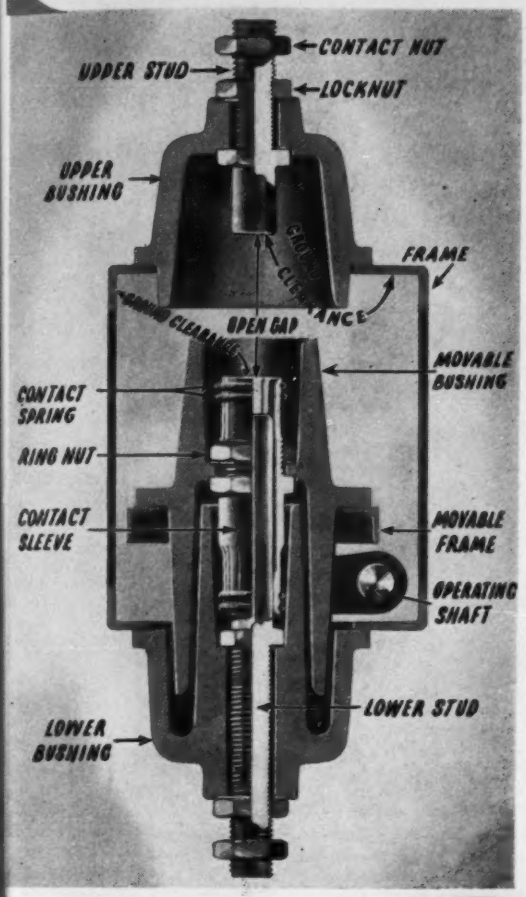
DAY BRITE
The Sign of Quality
Look for this Label

77

TODAY'S 3 DIMENSIONAL POWER-SUPPLY J

**QUESTION:** ***What is the most satisfactory method of disconnecting and terminating high voltage circuits?***

**ANSWER:** *The Three E Isolator and Cable Isolator*




The simple telescoping of bushings, shielding current carrying parts, mounted on a rigid compact frame is the ISOLATOR story in a nutshell.

The accompanying cross sectional view of a 5 K.V. ISOLATOR graphically portrays its excellent features as follows:

Provides full open gap.

Provides ample clearance to ground.

Shields all live parts, after outside connections are made and taped.

Overall dimensions remain constant whether ISOLATOR is open or closed.

Provides its own insulating barriers between phases.

Saves space in cubicles and bus structures.

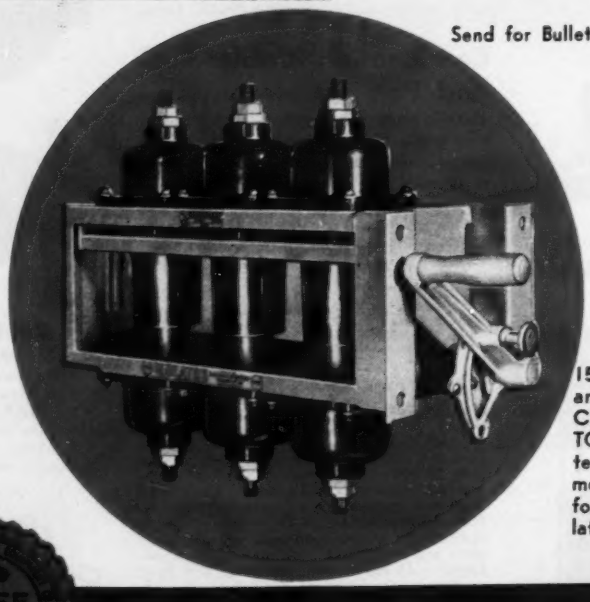
Existing bus structures which provided only enough space for hook stick operated disconnects can generally be modernized for group operation by using ISOLATORS.

By equipping studs with proper terminals, busses may be carried on ISOLATOR bushings saving bus supports and connections.

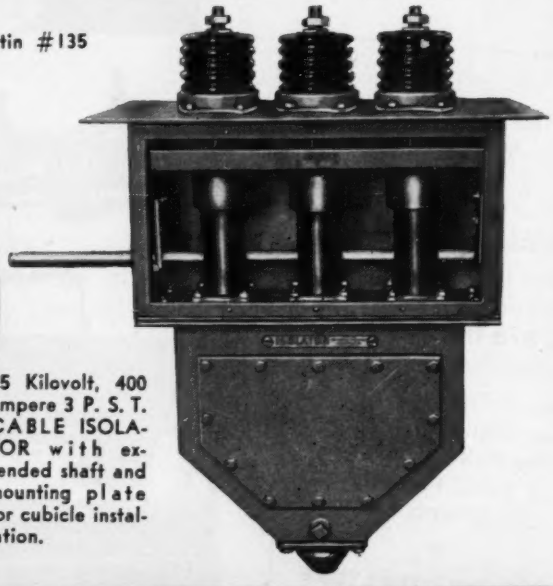
The CABLE ISOLATOR disconnects all phases in one operation and does not require use of dummies, dummy caps or other auxiliary equipment.

**ISOLATORS and CABLE ISOLATORS are also made for Outdoor Service.**

Send for Bulletin #135



5 Kilovolt 600 ampere 3 P. S. T. ISOLATOR arranged for panel mounting.



15 Kilovolt, 400 ampere 3 P. S. T. CABLE ISOLATOR with extended shaft and mounting plate for cubicle installation.

THREE E

ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK ILLINOIS

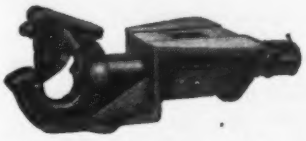
CALLS FOR *Threefold* SERVICE

Via GraybaR

# FWD LINE CONSTRUCTION AND MAINTENANCE EQUIPMENT THAT CONSERVES CRITICAL TIME AND MAN-POWER

**Model 1775 Pole Trailer** Especially adapted for high-speed hauling of poles over short and long distances. Because of its wide tread, this unit trails at high speeds without snaking or whipping. Light in weight, two men can easily lift it onto a truck when moving from one operation to another.

**Sure Binder** (Handiest tool you ever used) The Sure Binder is a portable hand winch for binding bulky loads of all types. Ratchet type drum holds 18 ft. of 5/16 inch cable. Weight complete: 18½ pounds.



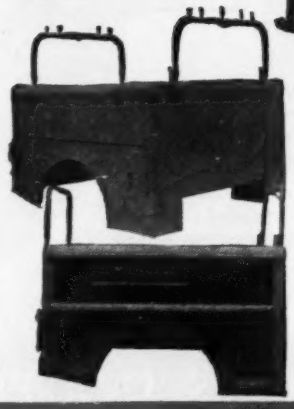
**Utility Pintle Hooks** Provide a sure, safe connection between truck and trailer — fit any make of truck. Available in sizes for pulling loads of 1 ton or less and up to the Universal type for towing anything that can be moved.

**M Type Pole Derrick** Made of he best seamless steel tubing properly ieat treated. Available in sizes to handle poles from 25 ft. to 70 ft. in length.

## OTHER UTILITY TOOLS

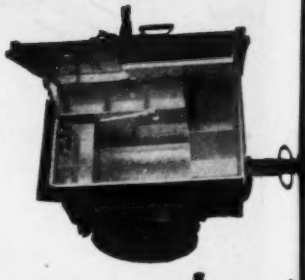
- Earth Boring Machines
- Power Take-Offs
- Duct Rodding Machines
- Low Bed Trailers
- Trailer Hitches
- Cable Laying Plows
- Steel Utility Bodies For Pick-Up Trucks
- Guy Wire Forming and Cutting Tools

SEND FOR LITERATURE



## First Choice OF MORE THAN 150 UTILITIES

FWD offers a complete line of engineered trucks for Utility service. Special power take-offs for operating a winch and boring machine are incorporated into its original design. FWD builds its own cabs and Utility bodies—can furnish conventional or over-engine cabs with seating capacity from 2 to 7 men ... Write for FWD catalog. "PUBLIC UTILITY TRUCKS THAT FOLLOW THE JOB."



**Cable Splicer's Cart—Model S** All steel construction—compact—rugged—theft-proof. Compartments for every tool. Folding support leg. Capacity 1000 lbs. Available with either solid or pneumatic tires.

**Combination Cable Reel and Pole Trailer** This unit has electric steel spoke wheels of integral hub type. Timken roller bearings, and special heat treated chrome vanadium steel springs. All castings are electric steel cast. Axle material is 40-50 carbon steel, specially heat treated. The main frame and cross member 4", 9½ lb. I-beam. All trailers furnished with one set of pole hauling bolsters, and one set of cable reel saddles.

**Combination Cargo and Pole Trailer**
P8T Series. Available in heavy load capacities of 3100 to 8200 lbs. Extension tongue permits hauling of poles up to 40 ft. Optional electric brakes, side boards, stanchions, etc.

**B-6 All Purpose Body**
A light weight compact all steel body designed for installation on any half ton chassis. Complete unit weight does not exceed 600 lbs. Storage compartments contain over 54,000 cubic inches. Full height clothing and material compartment. Corrugated steel floor, reduced weight increased strength. Full standardization of design permits easy replacement of damaged body parts or complete sub-assemblies. Tail gate can be secured at 45 degree position, level with floor or fully dropped. Rear ladder bracket removable. Telescoping door stops and solid wood insert converts upper rite door to full length work table and vise holder.

Graybar Quality Since 1869 — Everything Electrical ... THAT IT TAKES TO WIN!

**THE UTILITY SUPPLY DIVISION of the FOUR WHEEL DRIVE AUTO CO.** CLINTONVILLE, WISCONSIN

TODAY'S 3 DIMENSIONAL POWER-SUPPLY JO

# EVERSTICK ANCHORS

## *FOR TOUGH ANCHORING JOBS!*

War-time anchoring jobs bring Eversticks to the forefront. They provide tight, safe anchoring . . . always in excess of rated capacities. Easy and quick to install . . . made of finest grade malleable iron with superior rust-resistant qualities and exceptional toughness. Every Everstick is plainly marked for ease of handling and storing.

The nut housing feature of the Everstick prevents rod from slipping thru while installing and provides a solid substantial base for the expanding blades.

There's a complete line of Eversticks for all strain requirements. 15 sizes of 2-way—3-way—4-way types.

**EVERSTICK ANCHOR COMPANY, Fairfield, Iowa**

CALLS FOR *Threefold* SERVICE

Via GraybaR

# DELTABESTON

## *Designed for Busy War Motors*

Today motors run night and day to meet the unprecedented demand for electrical devices. Peak loads build up intense heat. Overloaded schedules that won't permit busy motors to "cool off" mean more heat. How long can ordinary magnet wire last under these conditions?

We recommend Deltabeston Asbestos- and Glass-insulated Magnet Wires for busy war motors. You'll find that despite severe conditions of overload the impregnated asbestos or varnished glass yarn insulation provides the necessary resistance to constant high temperatures.

Deltabeston Asbestos- and Glass-insulated Magnet Wires are designed for winding motors, lifting magnets, brake coils, generators, starters and other electrical equipment. Because its copper is extremely soft and flexible the most intricate coils can be formed without rupturing the insulation. Both Deltabeston and Deltaglass Magnet Wires are available in round, square and rectangular shapes covering a complete range of sizes.

★ ★ ★

Do you have a motor winding problem that requires a superior magnet wire? You can obtain additional information by requesting the Deltabeston Wire & Cable Catalog. Write to Section Y643-9, Appliance & Merchandise Dept., General Electric Company, Bridgeport, Conn. Deltabeston Wires and Cables are distributed nationally by Graybar Electric Company.

*Hear the General Electric radio programs: "The G-E All-girl Orchestra" Sunday 10 P.M. EWT, NBC. "The World Today" news every weekday 6:45 P.M. EWT, CBS.*

BUY
WAR BONDS
★

GENERAL ELECTRIC

TODAY'S 3 DIMENSIONAL POWER-SUPPLY JOB

**WORK-SAVING GREENLEE TOOLS**

- Hydraulic Conduit and Pipe Benders
- Steel and Copper Tube Benders
- Knockout Punches and Cutters
- Cable Pullers
- Joist Borers
- Hydraulic Pipe Pushers
- Spiral Screw Drivers
- Automatic Push Drills
- Electricians' Bits
- Bit Extensions
- Auger Bits
- Chisels and Gouges
- And many more

# . . . when you bend pipe with a GREENLEE

"Our GREENLEE Hydraulic Bender saves 50% on labor hours. We've been using it for 14 years now", states C. F. Miles, Superintendent, Squire Electric Co., Kansas City, Mo. A record like this shows that the GREENLEE Bender pays its own way—and actually earns money!

"Easily carried around the shop" . . . "simple to set up and operate" . . . "reduces material spoilage to minimum" are reports received daily from other electrical contractors using GREENLEE Benders.

Make smooth accurate bends where you want them . . . no kinking or other damage to conduit . . . no waiting for manufactured bends and fittings. Whatever your bending job . . . pipe up to 4½", rigid and thin-wall conduit, tubing or bus bars . . . there's a GREENLEE Bender to do it better, faster, easier . . . saving time, labor and money.

**WRITE FOR THIS FREE BOOKLET TODAY!**

See your electrical distributor or write for free booklets today. Get Booklet S-116 on complete line of Hydraulic and Hand Benders, Catalog 33E on time-saving tools for electrical work. Greenlee Tool Co., 1806 Columbia Avenue, Rockford, Illinois.

*Get Ready with Greenlee!*

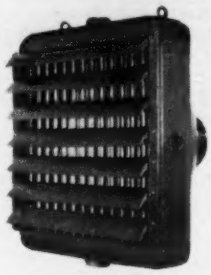
REGISTERED TOOLS

**GREENLEE**

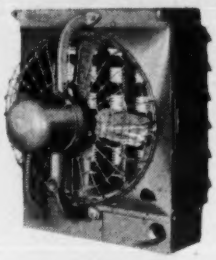
FOR THE CRAFTSMAN

CALLS FOR *Threefold* SERVICE

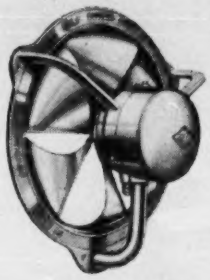
Via GraybaR



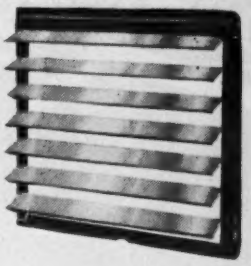
ILG "VITAL ZONE" UNIT HEATERS



ILG ELECTRIC UNIT HEATERS

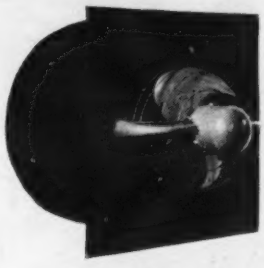


ILG SELF-COOLED MOTOR PROPELLER FANS

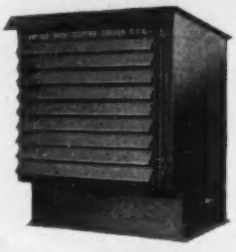


ILG AUTOMATIC SHUTTERS

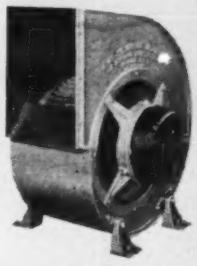
ILG PORTABLE FANS FOR "MAN-COOLING" DUTY



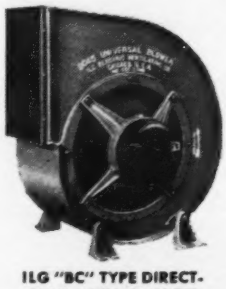
ILG DARK-ROOM VENTILATORS



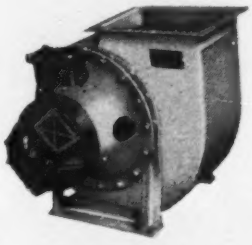
ILG POWER ROOF VENTILATORS



ILG "B" TYPE DIRECT-CONNECTED BLOWERS



ILG "BC" TYPE DIRECT-CONNECTED BLOWERS

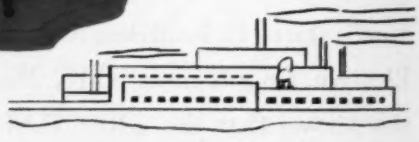


ILG "CC" TYPE DIRECT-CONNECTED BLOWERS

ILG "B" TYPE VOLUME BLOWERS

ILG "P" TYPE VOLUME BLOWERS

## YOU GET A "baker's dozen" WHEN YOU SPECIFY ILG EQUIPMENT!



*Not only* can you get a wide variety of heating and ventilating equipment from ILG . . . *not only* is this equipment available in a complete range of sizes and capacities . . . but you get the *extra* advantage of a ONE-NAME-PLATE Guarantee on *every* size, *every* type of ILG apparatus. The guarantee covers each product as a complete unit, *including the ILG-built motor . . . one* undivided responsibility! For help on any present or post-war applications of these or other ILG products, phone nearby Branch Office (see classified directory) or write us today.

**ILG ELECTRIC VENTILATING CO., CHICAGO 41, ILL.**
2885 N. CRAWFORD AVENUE ☆ OFFICES IN 38 PRINCIPAL CITIES

**free**

**48-PAGE CATALOG AND DATA BOOK!**
Get latest information on the complete ILG line from this handy, vest-pocket size, well-indexed catalog and data book. It's yours for the asking from your electrical distributor or from any ILG office.

ARMY E NAVY

**ILG VITALIZED VENTILATION**
AND AIR CONDITIONING

TODAY'S 3 DIMENSIONAL POWER-SUPPLY JO

# HUBBARD AUTOGAPS *Rain or Shine!*

Hubbard Autogaps are absolutely unaffected by moisture. Exhaust ports are designed so that rain cannot enter. The all-important fibre valve element is also unaffected by moisture content in the air or actual wetness. Due to these planned characteristics there is no need for sealing Hubbard Autogaps and relying on the permanence of the seal.

Inquiry indicates that engineers have shown greatest interest in the elimination of moisture from lightning arresters and consequent faulty operation. Rain or shine, use Hubbard Autogaps!

**HUBBARD AND COMPANY**

PITTSBURGH . . . OAKLAND ■ CALIFORNIA . . . CHICAGO

CALLS FOR *Threefold* SERVICE

*Via* GraybaR

# POWER

## ...For the 3 Dimensional supply job of War • Peace and the Post-war World

*A twist of the cap and it locks!*

*Twist-Lock* Receptacles and Armored Caps are used on these machines supplied to defense plants for drilling, counterboring and reaming holes in multiple operations.

Proven by "round the clock" service in today's war plants, and on the far-flung battlefronts, *Twist-Lock* Devices will provide an uninterrupted power supply for tomorrow's industrial world.

Look to Hubbell for the finest in wiring devices . . . Time-Proven . . . Battle-Tested.

***They never disconnect accidentally***

**HUBBELL**

***Twist-Lock***

**DEVICES**

**HARVEY HUBBELL, INC.** **BRIDGEPORT, CONN**

TODAY'S 3 DIMENSIONAL POWER-SUPPLY JO

# Crapo Steel Conductors

## More Than "Carry the Load" on Typical Rural Lines . . . . .

Crapo Steel Conductors are operating efficiently and economically on thousands of miles of rural lines like these illustrated here. You can cut costs, conserve material and labor, by specifying these conductors where applicable.

Operating experience shows that the average loads on rural taps and branches do not exceed one kilowatt per mile. *Crapo* Steel Conductor will carry these loads, under normal operating conditions, with a voltage drop of less than 3%.

This fact may be determined by calculating the voltage drop of a typical line. Let's consider a single-phase, 6900-volt line (with 0.90 power factor) using No. 6 B.W.G. *Crapo* HTC-130 Stranded (3-wire) Steel Conductor. The line is to be 9 miles long with a uniformly distributed load of one kilowatt per mile.

To determine the kilowatt-miles, you multiply 9 miles (length of line) by 9 kilowatts (one kilowatt per mile for 9 miles). The result is 81 kilowatt-miles.

When a load is uniformly distributed along the line, the kilowatt-miles will be twice the kilowatt-miles for a load concentrated at the far end.

The 81 kilowatt-miles, in the example above, divided by 2 is 40½ kilowatt-miles. The accompanying table, based on kilowatt-miles with the load concentrated at the far end of the line, shows that for a 6900-volt single-phase line, with 0.90 power factor, the voltage drop for 40 kilowatt-miles is 2%. The voltage drop for 40½ kilowatt-miles will be approximately the same.

**Kilowatt-miles of 6900-volt Single-phase and 12,000-volt Three-phase Circuits, No. 6 BWG *Crapo* HTC-130 Stranded (3-wire) Steel Conductor**

(Copyright 1940 by Indiana Steel & Wire Company)

Kilowatt-Miles with Load Concentrated at Far End of Line

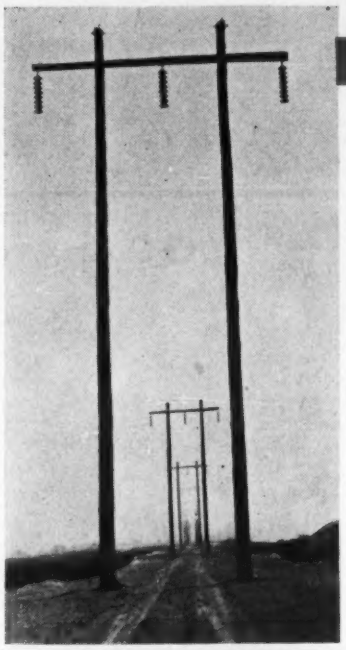
| Power Factor of Load | Single-phase 6900 Volts† | | | Three-phase* 12,000 Volts† | | |
|---|---|---|---|---|---|---|
| | 1% Drop | 2% Drop | 3% Drop | 1% Drop | 2% Drop | 3% Drop |
| 1.00 | 21 | 42 | 63 | 126 | 253 | 379 |
| 0.90 | 20 | 40 | 59 | 119 | 237 | 357 |
| 0.80 | 19 | 38 | 57 | 115 | 230 | 344 |

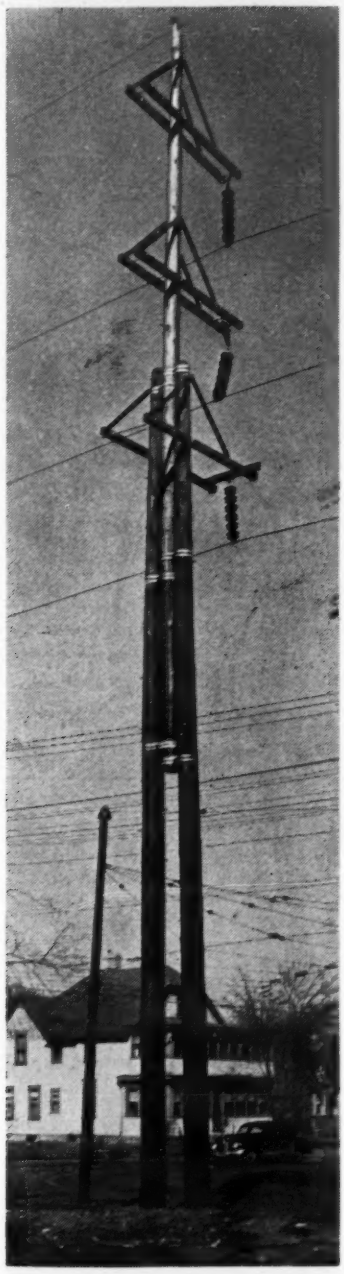
†Voltages are those delivered at end of line.
*Three-phase loads are balanced between phases.

*Crapo* Steel Conductors combine superior 60-cycle alternating-current characteristics with a rugged tensile strength which makes for important overall economy. Investigate the technical and economical advantages of these conductors for rural lines! Ask representatives of Graybar Electric Company, Distributors, or write for Engineering Manual containing complete technical information about *Crapo* Steel Conductors!

INDIANA STEEL & WIRE COMPANY . . . . . MUNCIE, INDIANA

CALLS FOR Threefold SERVICE Via GraybaR





# Lower Pole Line Costs with SUPER-CEDAR POLES

Whatever phase your 3-Dimensional Planning enters—NOW or in the FUTURE—*low costs* on Pole Line Construction and Maintenance are always worth attention.

NATIONAL SUPER-CEDAR Poles are getting more action in high places in the INDUSTRY every year, because of their record for long life and lowered maintenance.

The natural long life of CEDAR, its resistance to decay and to infestation by insects—is greatly enhanced by extra-thorough creosoting under sustained high pressure. With an incised, pressure-treated to uniform ½-inch of sapwood penetration their full length, these SUPER-CEDAR poles far outlast the normal lifetime service of average pole lines.

See the clean, straight, well-tapered appearance of NATIONAL POLES, in the photographs to the left. The upper view shows a line of pressure-treated Douglas Fir NATIONAL POLES, on a line just out of Chicago. The lower photo illustrates the adaptability of NATIONAL POLES to unusual assembly.

Write for the latest illustrated bulletin "Longer Life for the Lifelines." Yours on request.

## Five Points of FREEDOM

1. Freedom from heavy costs of yard sanitation.
2. Freedom in distribution along right of way. Freedom in yard storage time, in depth of setting.
3. Freedom in removing from line, in restoring time; in resetting to meet changes in load.
4. Freedom from excessive checking in service.
5. Freedom from infection—retort temperature kills incipient decay.

**NATIONAL POLE AND TREATING CO**

500 BAKER ARCADE BUILDING, MINNEAPOLIS 2, MINNESOTA

BRANCH OFFICES: CHICAGO, ILL. • SPOKANE, WASH. • EVERETT, WASH.

TREATING PLANTS

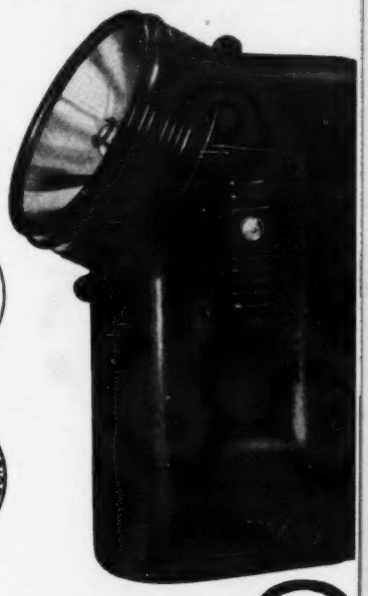
MINNESOTA TRANSFER, MINN. • EVERETT, WASH. • SPOKANE, WASH.

# Leaders IN AN OUTSTANDING LINE OF

# JUSTRITE *Electric Lanterns*

## INDUSTRIAL AND MARINE SAFETY TYPE

**No. 42-S** Approved by UNDERWRITERS' LABORATORIES, INC. for safe use in Class 1, Group D locations. Approved by U.S. BUREAU OF MARINE INSPECTION AND NAVIGATION for use in Pump Rooms of Tank Vessels. Has movable stand which serves as guard. Movable handle, clear glass globe, "throw-out" type bulb sockets. Furnished with one 5-volt .3 amp. bulb and one 5-volt .15 amp. bulb, and uses any regular 6-volt lantern battery. Switch and principal parts are easily removed and replaced, permitting quick adjustments or repairs. Body of lantern is 21-gauge steel.



## *The New* JUSTRITE SERVICE LIGHT

**No. 17-S** The lightweight plastic Electric Light with the famous Justrite Safety and service features. Approved by Underwriters' Laboratories for use in Class 1, Group D locations and by the U.S. Bureau of Mines for use in methane gas and air mixtures. Uses 3 standard size D dry cells to give 1500 candlepower beam which can be focused. Signal flasher in easily replaced switch. Can be carried upright by belt clip, reversed (for blackouts) by finger ring or stood on flat surface. See it today.

Plastic Penlight No. 11-J

Railroad Type No. 40

## JUSTRITE LANTERNS FOR EVERY USE

Here is a Justrite Lantern for every use . . . and every industry. Railroads . . . Ships . . . Oil Fields . . . Factories . . . Aircraft . . . and our Armed Forces all find good use for the Safety Lanterns, Inspection Lanterns, Penlights, Headlights and Floodlights. These Lanterns are available today only on high priorities. But, after peace, these sturdily built (and many new ones, too) will be available for all users. Plan your stock now . . . and keep your eye on Justrite.

All-Purpose Safety Type No. 44-S

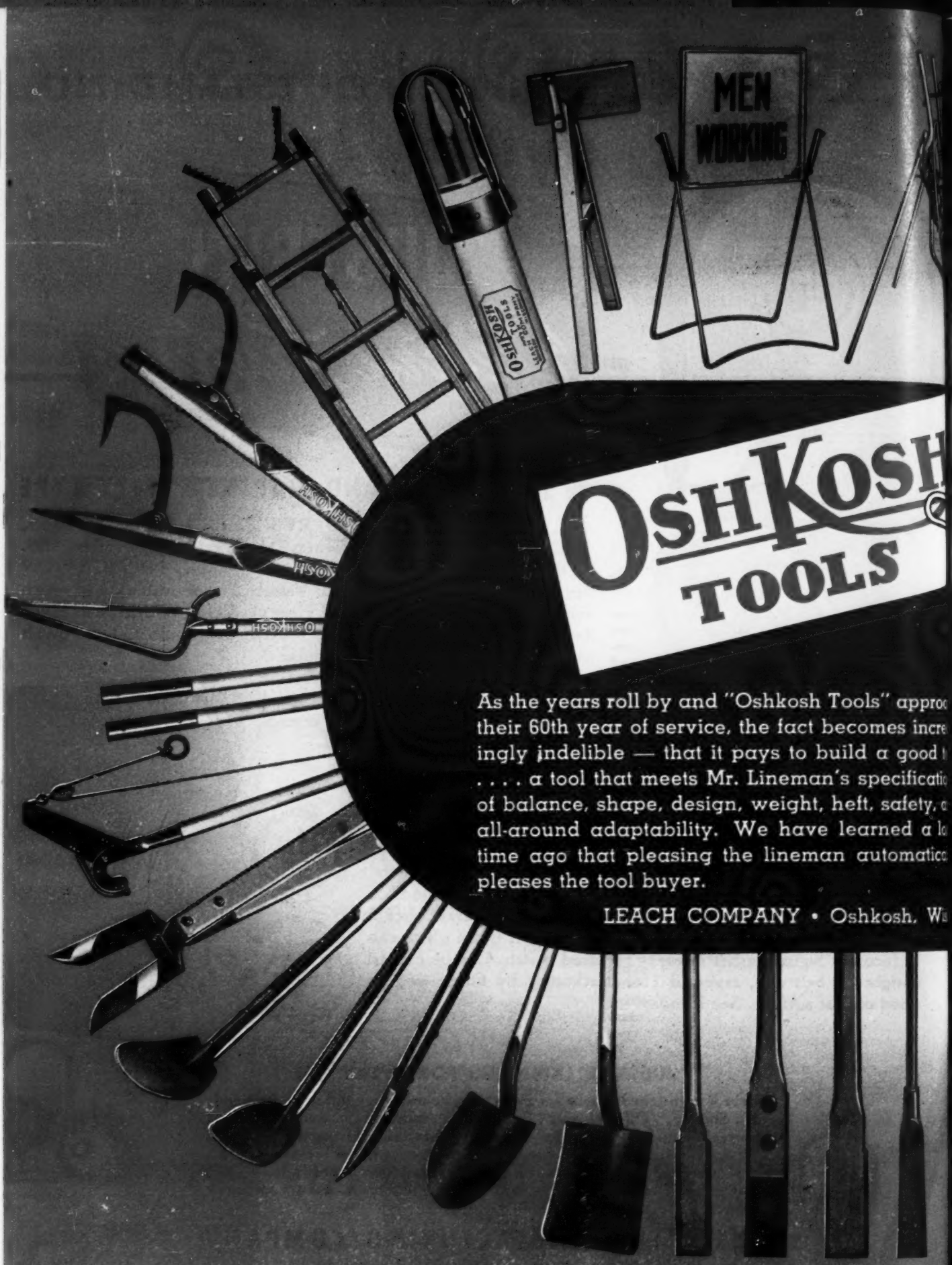
Safety Head Lantern No.

## JUSTRITE MANUFACTURING COMPANY

2063 N. Southport Ave., Dept. M-5, Chicago 14, Ill.

CALLS FOR *Thruflight* SERVICE

*Via* GraybaR




# OSHKOSH TOOLS

As the years roll by and "Oshkosh Tools" approc
their 60th year of service, the fact becomes incre
ingly indelible — that it pays to build a good
. . . . a tool that meets Mr. Lineman's specificatio
of balance, shape, design, weight, heft, safety, a
all-around adaptability. We have learned a lo
time ago that pleasing the lineman automatica
pleases the tool buyer.

LEACH COMPANY • Oshkosh, Wi

TODAY'S 3 DIMENSIONAL POWER-SUPPLY JO

# FOR PRESENT-DAY AND PROPOSED JOBS

## *Insist On*

## JEFFERSON ELECTRIC
## BALLASTS, TRANSFORMERS, FUSES

## *For Maximum Performance*

Given first rank by experienced electrical and maintenance men for uniform quality of design and construction, Jefferson Electric Transformers, Ballasts, and Fuses invariably are specified when top performance is vital. Minimum attention and maintenance, and long life reliability mean lower overall cost.

Jefferson Electric products are handled by leading wholesalers for your convenience—specify them when ordering.

Ballasts with Bottom Leads save material and time since they may be mounted on narrow wiring channels above the fixture. They are available in the popular capacities: two- and three-lamp, 40 watt; two- and four-lamp, 100 watt.

### FLUORESCENT LAMP BALLASTS

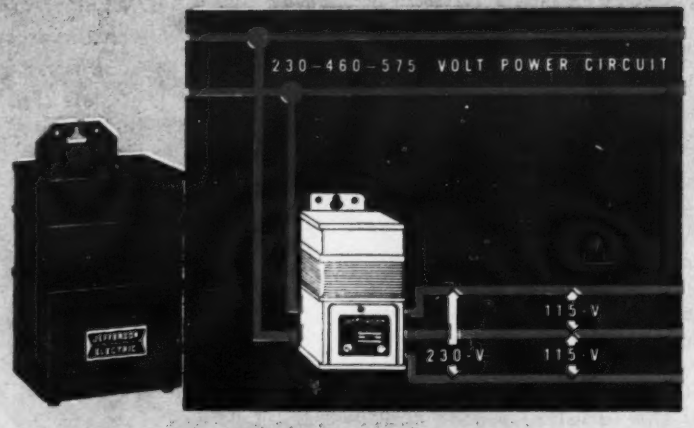
Long-hour operation demands the best in fluorescent lighting and the best in Ballasts. Jefferson Electric Ballasts are available for use with all commonly used fluorescent lamps and in single- and two-lamp types. For full data, see new Bulletin 441-FL.

### JEFFERSON TRANSFORMERS
#### FOR MERCURY LAMPS

Correctly designed and coordinated to govern the current through the starting and operating cycles of mercury lamps, Jefferson Transformers meet the most exacting requirements. They insure maintained high efficiency.

Tested and approved by Electrical Testing Laboratories of New York, they are listed also by Underwriters' Laboratories, Inc., and carry the Underwriters' Re-examination Service Label. Indoor and Outdoor Transformers are made in all standard capacities, single- and two-lamp types.

### TRANSFORMERS for POWER CIRCUITS




Eliminate duplicate high and low voltage circuits. Distribute only the 230 to 575 volt service—and provide the 115 volt current where needed for lamps, small tools and appliances by means of Jefferson Electric dry type Power Circuit Transformers.

### JEFFERSON UNION RENEWABLE FUSES

Proper fusing eliminates unnecessary shutdowns and damage to motors, wiring and equipment. Delays interfere with all-out production.

Jefferson Renewable Fuses provide the safe, reliable protection required. When excessive overloads require these fuses to open the circuit, they do it safely. Their rugged construction and simple design permit quick cleaning and easy renewal.

JEFFERSON ELECTRIC

JEFFERSON ELECTRIC COMPANY • Bellwood (Suburb of Chicago), Illinois

In Canada: Canadian Jefferson Electric Co., Ltd., 264 Pape Avenue, Toronto, Ont.

CALLS FOR *Threefold* SERVICE — Via GraybaR

# FACTS ABOUT *Nicopress*

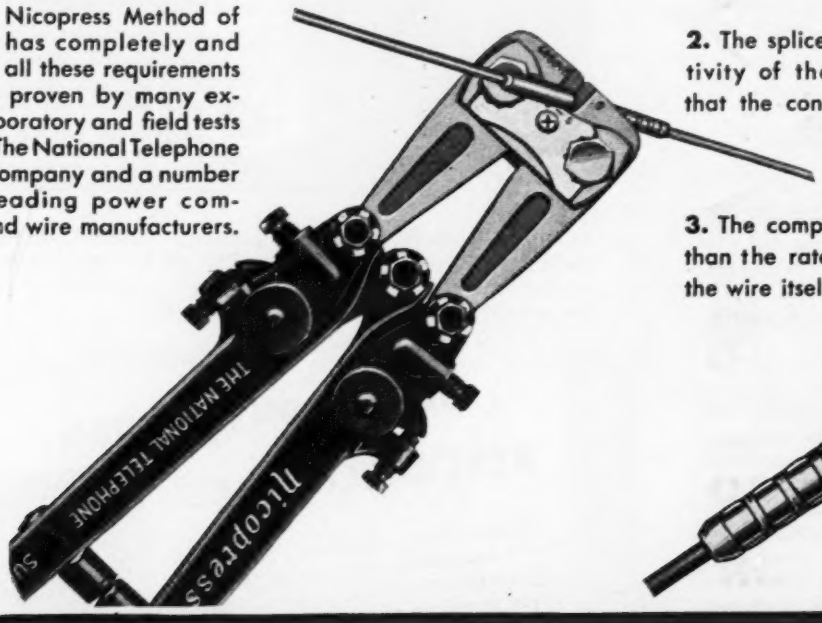
## SPLICING SLEEVES

### for "80" and "130" High Tensile Steel Power Conductors!

SLEEVE BEFORE COMPRESSING WITH NICOPRESS TOOL

**1.** Whether the joint is to be made in the air or on the ground, the job can be done faster and easier with Nicopress steel conductor sleeves.

That the Nicopress Method of Splicing has completely and fully met all these requirements has been proven by many exacting laboratory and field tests made by The National Telephone Supply Company and a number of the leading power companies and wire manufacturers.




**2.** The splice will equal the conductivity of the wire and is so tight that the conductor *cannot pull out.*

**3.** The completed splice is stronger than the rated breaking strength of the wire itself.

COMPLETED SPLICE

*The National Telephone Supply Company*

8100 SUPERIOR AVENUE • CLEVELAND 5, OHIO

Canadian Mfr.—N. SLATER CO., LTD., HAMILTON, ONT., CANADA

Export Distributor—INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

THE NATIONAL TELEPHONE SUPPLY COMPANY

TODAY'S 3 DIMENSIONAL POWER-SUPPLY JO

FRAMED TO GIVE A CLEAR VIEW OF THE ENTIRE OPERATING MECHANISM. NO COVER TO REMOVE TO CHECK THE CONTROL.
THE MERCURY SWITCH IS IMMUNE TO DUST, DIRT OR CORROSION. IT ASSURES BETTER CONTROL PERFORMANCE AND LONGER CONTROL LIFE.
MERCOID
SWITCH
THE CALIBRATED DIAL AND POINTERS PLAINLY INDICATE THE OPERATING RANGES. ALL GUESSWORK IS ELIMINATED
THE OUTSIDE DOUBLE ADJUSTMENT SIMPLIFIES SETTING THE OPERATING RANGE. A LOCKING DEVICE IS PROVIDED.

## MERCOID "DA" CONTROLS ARE IDEAL FOR THOSE TEMPERATURE OR PRESSURE CONTROL PROBLEMS

Mercoid "DA" Pressure and Temperature Controls are used on numerous industrial applications. Their dependable performance has made them a favorite among leading industrial engineers.

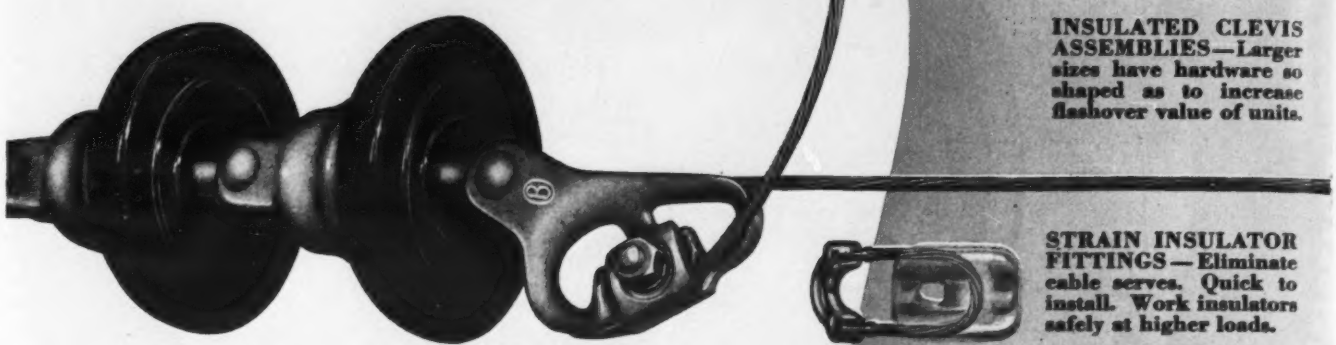
Both, Temperature and Pressure Controls, are equipped with corrosion proof mercury switches, and have the same desirable outside adjustment feature. Many ranges available. Mercoid catalog No. 600 will give you more detailed information. Write for a copy.

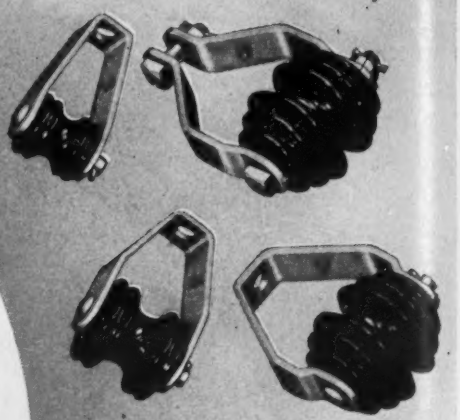
**THE MERCOID CORPORATION, 4201 WEST BELMONT AVE., CHICAGO 41, ILLINOIS**

CALLS FOR *Threefold* SERVICE Via GraybaR

# *How to build*

## HIGH-VOLTAGE RELIABILITY INTO LOW-VOLTAGE LINES





**INSULATED CLEVIS ASSEMBLIES**—Larger sizes have hardware so shaped as to increase flashover value of units.

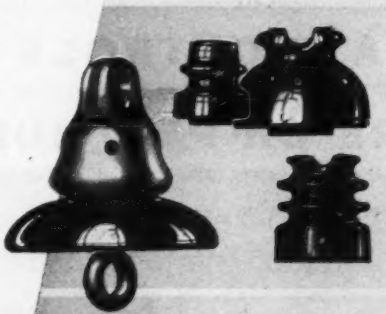


**STRAIN INSULATOR FITTINGS**—Eliminate cable serves. Quick to install. Work insulators safely at higher loads.

**DEAD END THIMBLES**—Permit replacement of insulator without cutting or disturbing conductor. Also applicable to angles.

**ANGLE CLAMPS**—One clamp fits full range of cable sizes. Fits angle construction from 10 to 120 degrees.

**UNIVERSAL STRAIN CLAMPS**—Develop full cable ultimates. Slip strengths in excess of 90 per cent of ultimate.



**INSULATORS**—All made of fine, high-voltage, wet ware porcelain. Superior manufacturing and design standards show up in superior performance.

**NEUTRAL CLAMPS**—For grounded neutral conductor. Main jaw is threaded so that clamp remains tight regardless of pole shrinkage.

*LINE* outages can't be rated in terms of voltage--it takes the time of men to restore service, whether the line is 1,000 or 100,000 volts, and men's time today is a scarce article. Also, because there are so many low-voltage lines, it is doubly imperative to build these lines well. You can be sure of this when you use O-B insulators and hardware...The same designing skill, the same research facilities, the same fine materials, and the same manufacturing plant are behind O-B distribution materials as behind those for the heaviest-voltage applications. O-B low-voltage equipment is built with a high-voltage point of view that shows up in greater reliability... And it's easy to buy O-B distribution materials. Just reach for your telephone and call your nearest Graybar Electric representative.

2479-H

**Ohio Brass** Distributed by GraybaR ELECTRIC COMPANY

MANSFIELD, OHIO

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.


TODAY'S 3 DIMENSIONAL POWER-SUPPLY JO

# A REPORT OF PROGRESS

## SYNTHETIC RUBBER

### INSULATIONS AND SHEATHS ON SIMPLEX WIRES AND CABLES

During the past few months a new synthetic rubber compound has been developed to replace each special purpose natural rubber insulation and sheath that has been used on Simplex wires and cables. The results seem miraculous but they are not the result of wishful thinking or crystal gazing. They are solid facts, based on knowledge and skill accumulated during the past sixty years, which make it possible for us to make the most of new insulating materials and do it quickly.

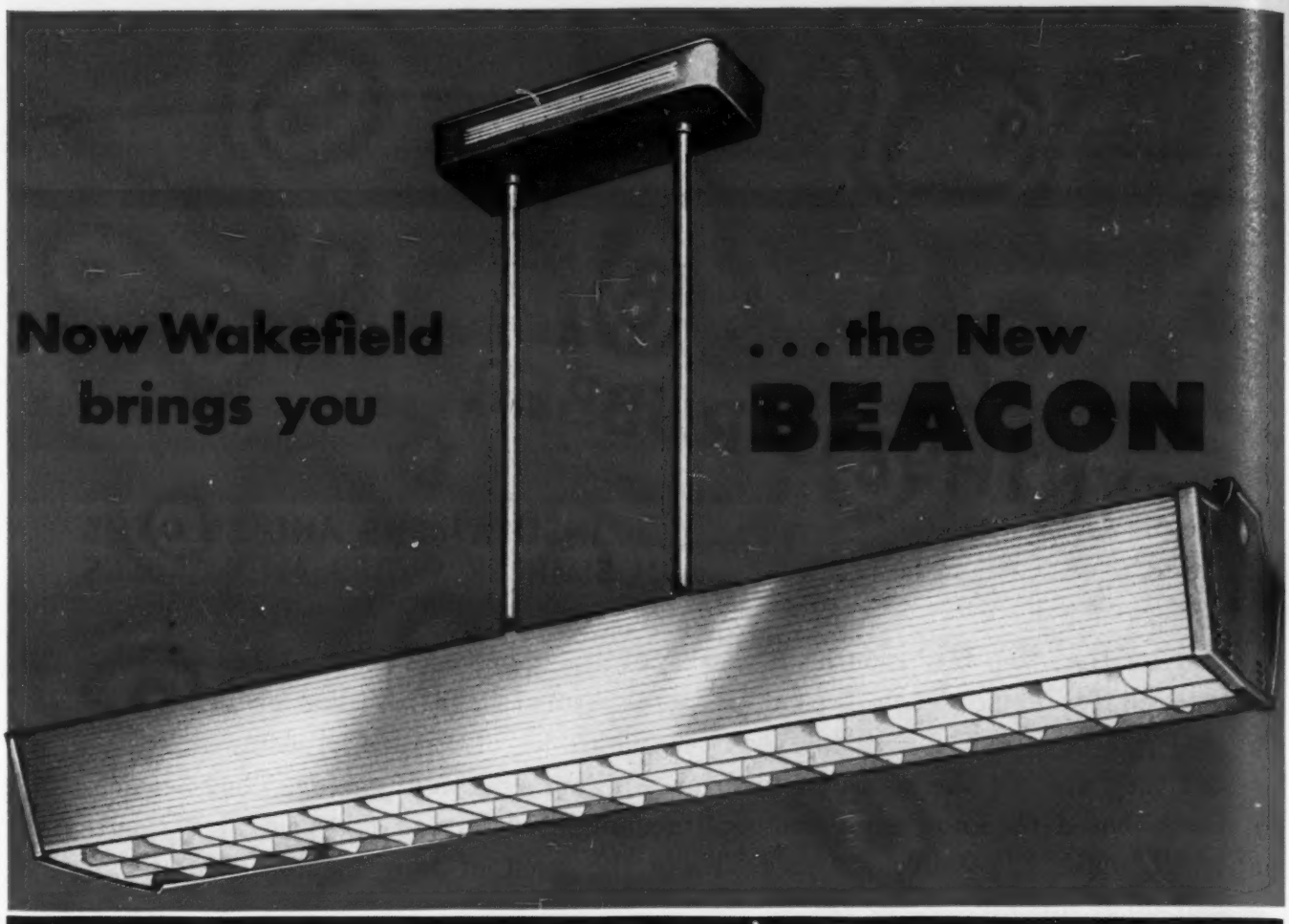
If you use insulated wires and cables for any purpose you will be interested in what we have accomplished with the synthetic rubber insulations and sheaths that are now being used on all Simplex wires and cables. The story is told in an up-to-date booklet entitled "A Report to Industry on Simplex Synthetic Rubber Insulations". It is now being printed and we would like to send a copy to you as soon as it is ready for distribution. A request by postcard or letter to the Simplex representative nearest you or direct to us at Cambridge will have prompt attention.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

# Simplex WIRES and CABLES

CALLS FOR Threefold SERVICE

Via GraybaR




## . . . to help you serve your customers *better*!

DESIGNED for high quality fluorescent lighting at lower cost, the BEACON is a "honey" for lighting essential offices or drafting rooms. Provides smooth, shadowless light to help handle paper work faster and reduce eyestrain.

Maintenance is especially easy since there are no horizontal surfaces on which dust can collect. Hinged louvers make lamp replacement easy.

Etched, ribbed glass on the side panels gives smooth, pleasing light; louvers on the bottom of the unit prevent direct view of the lamps.

Ballasts are only partially enclosed — which means cooler, better operation.

The new BEACON is of all-steel construction. Metal end caps are pierced in a decorative design and are backed up with diffusing, translucent plastic. And you can offer this 4-lamp fluorescent unit in stem suspension as pictured, or with close-up mounting for low-ceiling areas. Get the details NOW from Graybar or write us.

★ ★ ★

**ALSO THE CAPTAIN**

A new, low cost, exposed lamp fixture by Wakefield. 4-lamp unit . . . available through Graybar.

ASK YOUR GraybaR HOUSE ABOUT

LIGHTING EQUIPMENT BY **Wakefield**

RED SPOT LIGHTING FOR WAR PRODUCTION . . . FOR PEACETIME FUTURE

TODAY'S 3 DiMENSIONAL POWER-SUPPLY JO

# Speed up vital Construction with

## Reliable

## STRAIGHTLINE SPLICES and DEAD ENDS

Illustrations Actual Size For No. 4 Solid Copper Wire

Furnished in Sizes from No. 8 Strand to 250 MCM Copper

### *Summary of* RELIABLE PRODUCTS

- Split Bolt Connectors—for Copper Wires
- Special Plated Connectors—for Aluminum, Plated or Steel Wires
- Service Entrance Connectors, Flip-on Tap Clamps, Ground Rod Clamps and Solderless Lugs
- Straightline Splices and Dead Ends for Distribution and Transmission Lines
- Splicing Sleeves for Overhead and Underground Construction
- Cable Pulling Grips, Steel or Bronze
- Cable Hangers, Zinc or Copper
- Telephone Protectors, Cable Terminals, Outside Plant Specialties

**Reliable ELECTRIC COMPANY**

3145 Carroll Ave., Chicago, Illinois

CALLS FOR *Threefold* SERVICE

*Via* GraybaR

A DEVICE FOR EVERY ELECTRICAL HAZARD

# SALISBUR

## RUBBER PROTECTIVE DEVIC

FOR LINEMEN AND OTHERS WHO WORK ON OR NEAR ENERGIZED EQUIPMENT. APPROVED BY SAFETY ENGINEERS FROM COAST TO COAST. • ADOPTED FOR SAFETY BY PUBLIC UTILITY COMPANIES EVERYWHERE. • DESIGNED FOR MAXIMUM DEPENDABILITY AND CONVENIENCE IN USE. • MADE FROM HIGHEST GRADE MATERIALS BY THE PIONEERS IN MANUFACTURE OF RUBBER PROTECTIVE EQUIPMENT FOR LINEMEN

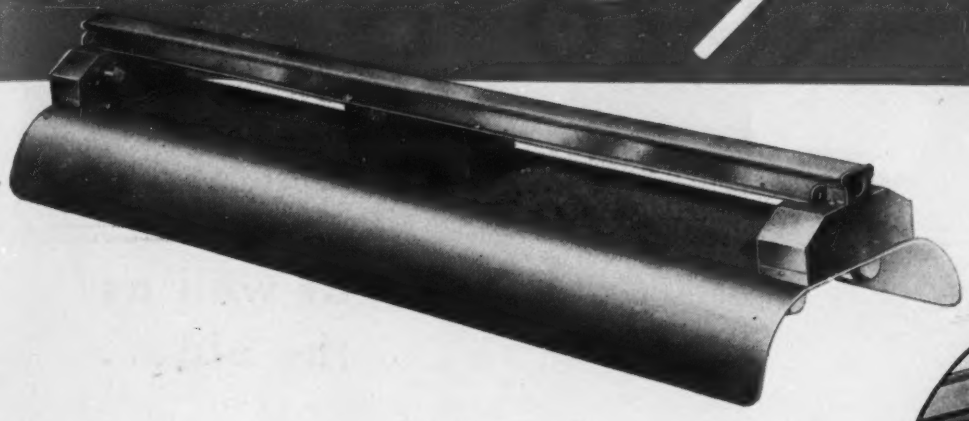
*Write for Catalog L-4*

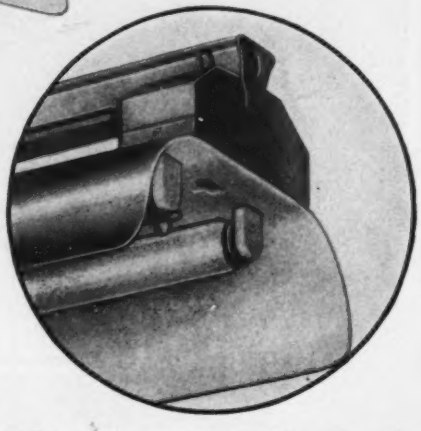
## W. H. SALISBURY & C

GENERAL OFFICE AND FACTORY
401 NORTH MORGAN STREET, CHICAGO

TODAY'S 3 DIMENSIONAL POWER-SUPPLY JO

# Outside, Inside . . . it's *Skilled Lighting!*





Rigid, weight-conserving wiring channels. Easily accessible operating parts. Reflection factor not less than 85% gives better than 80% overall efficiency in 48" two-lamp units, 76% in three-lamp units, 74% in 60" two-lamp units.

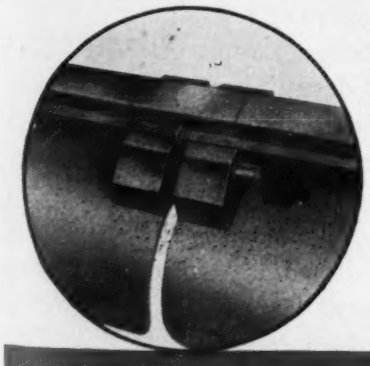
Compare a Wheeler 1944 RLM Fluorescent Fixture with any other fixture made in accordance with latest WPB requirements. Its trim, compact appearance truly indicates its simple, sound engineering, *outside and in!*

Wiring channels, for example, are hollow steel I-beams combining light weight and extreme rigidity. Provide durable support, easy adjustable suspension, instant access to starter switches.

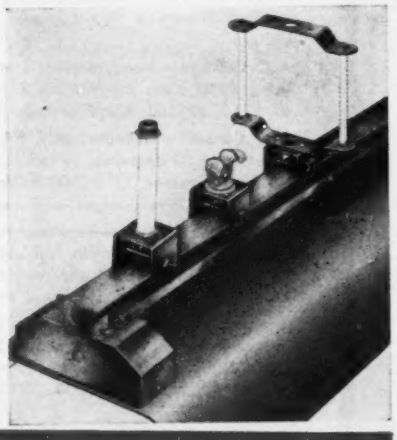
The reflectors, too, are typical Wheeler "Skilled Lighting" . . . designed with the "know how" of 62 years' experience. Made from tough, non-flammable, moisture-resistant material . . . chip-proof, washable enamel, inside and out. Rugged, light-weight, durable. And higher in lighting efficiency than many porcelain-enameled metal reflectors!

Write for detailed Bulletin 72. **Wheeler Reflector Co., 275 Congress St., Boston 10, Mass., . . .** New York City. Representatives in principal cities.

**DISTRIBUTED EXCLUSIVELY THROUGH ELECTRICAL WHOLESALERS**



**Continuous Installations** easily made by simple connection of adjacent ends with speedily-applied couplings. Note accessibility of starter switches.



**"C-Clamp" Hangers,** easily attached, fully adjustable . . . afford conduit, messenger cable, rod or close-to-ceiling suspension. Loops set each end of wiring channel provide for chain suspension. Ample knockouts offer a choice of entrance and permit straight-through wiring of entire row of fixtures.

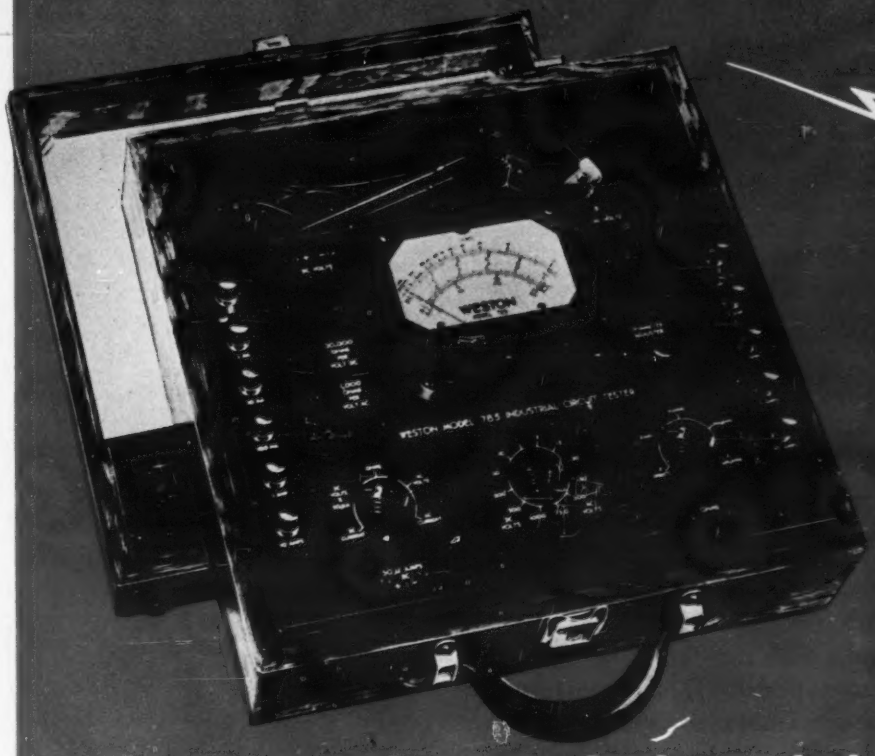
# Wheeler REFLECTOR COMPANY

LIGHTING EQUIPMENT SPECIALISTS SINCE 1881

CALLS FOR *Threefold* SERVICE

*Via* GraybaR

# MEASURES THE *new* MAINTENANCE VALUES



as well as the old . . .

## Weston MODEL 785 Industrial Circuit Tester

**RANGES**

**D-C Voltage**—*Measurements from 10 millivolts to 1000 volts (20,000 ohms per volt) in full scale ranges of: 1/10/50/200/500/1000 volts. (Up to 5000 volts with very compact external multiplier.)*

**A-C Voltage**—*Measurements from 0.1 to 750 volts (1000 ohms per volt) in full scale ranges of: 5/15/30/150/300/750 volts.*

**D-C Current**—*Measurements from 0.5 microampere to 10 amperes, in full scale ranges of: 50 microamperes, 1/10/100 milliamperes, 1/10 amperes. (Higher ranges with external shunts.)*

**A-C Current**—*Measurements from 10 milliamperes to 10 amperes, in full scale ranges of: .5/1/5/10 amperes. Higher ranges, up to 1000 amperes, with external current transformers.*

**Resistance**—*Measurements from 0.5 ohm to 30 megohms in full scale ranges of: 3,000/30,000/300,000/3 meg./30 meg. Center scale values are: 25/250/2,500/25,000/250,000 ohms.*

• The growing use of electronic devices and other sensitive circuits throughout industry poses no new instrument problems for contractors or maintenance departments WESTON equipped. The familiar Model 785, with its high sensitivity and broad range scope, answers these *newer* measurement requirements. But more . . . it also covers most of the *usual* maintenance needs.

Model 785 furnishes another example of WESTON'S engineering foresight . . . designing instruments always with the needs of *to-morrow* in mind. Other WESTONS, equally important for efficient maintenance in the days to come, are the time-saving WESTON Clamp Ammeter, and the WESTON foot candle meters which measure all types of lighting direct . . . *without correction factors.* Weston Electrical Instrument Corporation, 578 Frelinghuysen Avenue, Newark 5, New Jersey.

**Laboratory Standards . . . Precision DC and AC Portables . . . Instrument Transformers . . . Sensitive Relays . . . DC, AC, and Thermo Switchboard and Panel Instruments.**

# WESTON

**Specialized Test Equipment . . . Light Measurement and Control Devices . . . Exposure Meters...Aircraft Instruments... Electric Tachometers...Dial Thermometers.**

MORE OVER 25 YEARS' EXPERIENCE IN ELECTRICAL MEASURING INSTRUMENTS

TODAY'S 3 DIMENSIONAL POWER-SUPPLY JOB

# HEMINGRAY INSULATORS

Favorably Known Since 1870

## "Neither rain, nor snow, nor gloom of night..."

HEMINGRAYS are made as you would like to have them made. Under exacting step-by-step quality production control!

They're tough and strong — built to withstand any change of weather.

They defy rain and snow and sleet. They stand faithfully on guard through the hottest days of summer, the coldest nights of winter.

Many of these famous insulators are still in use after 20, 30, and even 50 years of service.

*Dependable, long-life service!* That's what you get when you specify Hemingray Insulators!

Hemingrays are sold by principal jobbers and are manufactured by Owens-Illinois, Hemingray Division, Muncie, Ind.

## OWENS-ILLINOIS

HEMINGRAY DIVISION • MUNCIE, IND.

CALLS FOR *Threaded* SERVICE

Via GraybaR

# FIRMS LIKE THESE ARE THE *Starting Point*

Adam Electric Company, Frank
American Crossarm & Conduit Company
American Manufacturing Company
Armstrong Cork Company
Benjamin Electric Manufacturing Company
Bryant Electric Company
Bull Dog Electric Products Company
Bussmann Manufacturing Company
Chance Company, A. B.
Coffing Hoist Company
Curtis Lighting Inc.
Day-Brite Lighting Inc.
Electrical Engineers Equipment Company
Everstick Anchor Company
Fibre Conduit Company, The
Four Wheel Drive Auto Company
General Cable Corporation
General Electric Company
Greenlee Tool Company
Hubbard & Company
Hubbell, Inc., Harvey
Ilg Electric Ventilating Company
Indiana Steel & Wire Company
Jefferson Electric Company
Justrite Manufacturing Company
Leach Company
Mercoid Corporation
National Pole & Treating Company
National Telephone Supply Company, The
Ohio Brass Company
Owens-Illinois, Hemingray Division
Reliable Electric Company
Salisbury Company, W. H.
Simplex Wire & Cable Company
Thomas & Betts Company, Inc., The
Wakefield Brass Company, F. W., The
Weston Electrical Instrument Corporation
Wheeler Reflector Company

## *for* GraybaR *Threefold* SERVICE

**FIRST, LENGTH OF EXPERIENCE!** The accumulated experience of seventy-five years in the electrical industry reaches you — via Graybar.

**SECOND, BREADTH OF LINE.** Superior electrical products from more than two hundred manufacturers flow to you — via Graybar.

**THIRD, DEPTH OF KNOWLEDGE.** Graybar has trained Specialists in all fields, such as line-construction, lighting and power apparatus. The services of these men are yours for the asking.

Graybar brings you the supplies you need for war, today. We are prepared to aid conversion problems as the availability problem eases. Finally, we will mobilize new product information to help you plan for tomorrow as fast as it is released. We suggest that you call Graybar, today.

# GraybaR

**IN OVER 80 PRINCIPAL CITIES**

GraybaR QUALITY *REG. U.S. PAT. OFF.

75 YEARS OF *Electrical Distribution*

# NEWS ABOUT PEOPLE

## Ober Made Vice-President of Cleveland Utility

Dean C. Ober was elected a vice-president of the Cleveland Electric Illuminating Co. at a recent meeting of the company's board of directors and will be in charge of engineering and operations.

Mr. Ober began his career with the

company while a student of electrical engineering at Case School of Applied Science, working for the company during his college vacations. He was graduated from Case in 1913, and the following year went to work for the company as an electrical engineer. In 1933 he was promoted to executive engineer, and later was appointed manager of operations.

•

▶ ALBERT E. GRAUER, secretary of the British Columbia Electric Railway Co. at Vancouver, B. C., has been elected vice-president of the B.C. Power Corp., which controls the British Columbia Electric Railway Co. Dr. Grauer succeeded the late William Saville as secretary in 1939.

▶ GEORGE L. A. THOMSON, of the testing laboratory, Public Service Electric & Gas Co., Newark, N. J., has been appointed assistant to the laboratory engineer. Mr. Thomson was employed in the testing laboratory in 1906 and has served as electrical division chief since 1923.

▶ FRED S. MASON, Brockton (Mass.) Edison Co., has been elected chairman of the Lighting Engineers Club of New England, Frank H. Jones, Lowell (Mass.) Electric Light Corp., being vice-chairman, and Frank Spanno, Malden (Mass.) Electric Co., secretary-treasurer. Frank T. Hitchcock, Boston Edison Co., is the retiring chairman.

•

## New Appointments Made by Wisconsin Utility

Wisconsin Public Service Corp., has announced changes in executive personnel occasioned by the resignation of Allan C. Davey, sales manager, who has joined the Clark Water Heater Division of the McGraw Electric Co. in a similar capacity. Arnold G. Bur, assistant treasurer and division auditor at Green Bay since 1930, has been appointed to succeed Mr. Davey. He will continue to live at Green Bay and will move the sales manager's office there. Mr. Davey was located in Oshkosh.

A new position, that of assistant sales manager, has been created and will be filled by Dale Remington, at present advertising manager. Mr. Remington will continue to have his office at Green Bay and will add the new duties to those previously handled by his department. He has been employed since 1925 in sales and advertising positions with the company at Green Bay and Oshkosh.

Effective at the same time is the appointment of Robert C. Horn as division auditor at Green Bay, succeeding Mr. Bur.

A. G. Bur

•

## S. B. Williams Elected President of I.E.S.

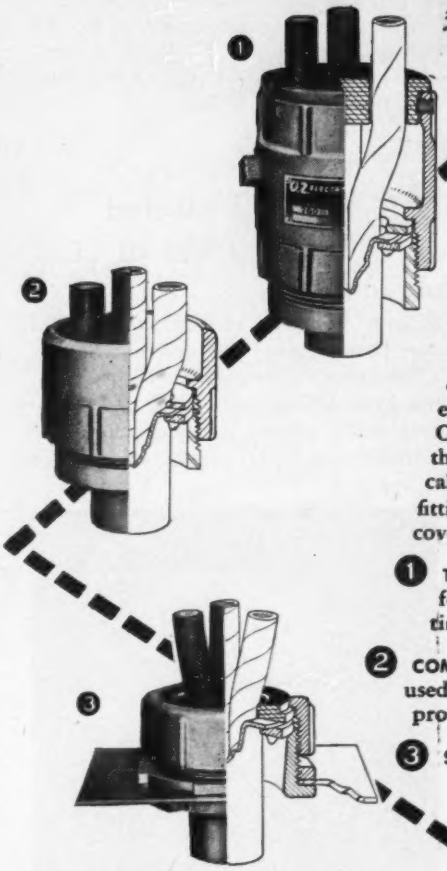
S. B. Williams, editor of ELECTRICAL WORLD, who was elected president of the Illuminating Engineering Society (ELECTRICAL WORLD, June 17, page 4), has been active in the Society for several years, serving as chairman of its advisory planning committee since it

was created in 1940, and as a member of its post-war planning committee.

Mr. Williams has been editor of ELECTRICAL WORLD since 1938. He first joined the staff in 1914, resigning in 1922 to become managing editor and later editor of *Electrical Record*. Two years later he left that paper to take charge of the *Electragist* as editor and manager. In 1928, when the *Electragist*, since known as *Electrical Contracting*, was purchased by the Electrical Trade Publishing Co., Mr. Williams remained as editor, until his transfer to the managing editorship of ELECTRICAL WORLD in 1936.

Mr. Williams received the degree of electrical engineer from Princeton in 1914. He is chairman of the Lamme Medal Committee and a member of the Post-War Planning Committee of the American Institute of Electrical Engineers. For the past two years he has been secretary of the James H. McGraw Awards Committee for recognition of

# NOW THERE'S AN O.Z. INDOOR CABLE TERMINATOR FOR EVERY JOB

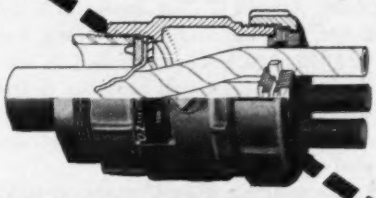


O. Z. has added many new fittings to their line of Cable Terminators to meet the increased demand for their use in sewerage disposal plants, oil refineries, steel mills, office buildings, power stations, synthetic rubber plants, pumping stations, chemical and industrial plants, etc. In expanding their line of Cable Terminators, O. Z. engineers have drawn upon their more than 25 years close association with electrical industries to produce a complete line of fittings for use with lead covered and rubber covered cables in the following classifications:

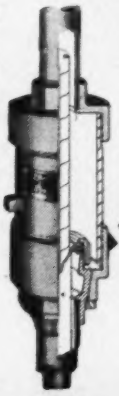
1. **TERMINATING POTHEADS,** substantial units for sealing conduit and cable ends. This fitting has ample space for sealing compound.
2. **COMPOUND BUSHINGS,** compact sealing units used where space is limited. Small reservoir is provided for compound.
3. **SEALING BUSHINGS,** for use in cabinets, control boxes, etc. No compound chamber is provided and with its reduced height a minimum of space is required.

**AT A GLANCE,** find the proper fitting among 55 classified photo-diagrams, each complete with description, dimensions and prices in O. Z.'s new 144-page catalog. Results of tests made by an independent testing laboratory will be found on page 24 of the catalog. Contains similar information on more than 160 O. Z. fittings including CONDUIT FITTINGS • JUNCTION BOXES • SOLDERLESS CONNECTORS • POWER CONNECTORS • GROUNDING DEVICES.

Designers and engineers who are planning post war building or reconversion can enjoy the purchasing advantage of using O. Z. as a single high-quality source of supply. Write on your business letterhead for your free copy.



HORIZONTAL TERMINATORS have an added sealing device at the top, permitting their use in any position.



"J" TERMINATORS incorporate the general principles of O. Z. Terminators, with the addition of a collapsible feature making an easily installed device for terminating and sealing or as a pulling and splicing chamber.

5672

**O.Z. ELECTRICAL MFG. CO.**

262 BOND STREET • BROOKLYN, 2 N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES


meritorious achievement among electrical men.

▶ J. L. SHORES has been named safety engineer of the Alabama Power Co. to succeed Joe Speed, resigned. Mr. Shores has been in the safety department of the company since 1925 and since 1938 has been safety engineer for the eastern and western divisions, Gorgas and Gadsden steam plants, and Lay and Mitchell dams.

•

## N. Y. Electrical Society Elects New Officers

George F. Bateman, dean, Schools of Engineering, The Cooper Union, was elected president of the New York Electrical Society at its annual meeting held recently.

Other officers elected were: first vice-president, Dr. Colin G. Fink, professor of electrochemistry, Columbia University; second vice-president, Dr. Ernest Weber, research professor of electrical engineering, Polytechnic Institute of Brooklyn. E. E. Dorting, of the New York City Transit System, was re-elected treasurer. Preston S. Millar, president of Electrical Testing Laboratories, Inc., who has served as president during the past year, becomes junior past president for the 1944–45 term.

•

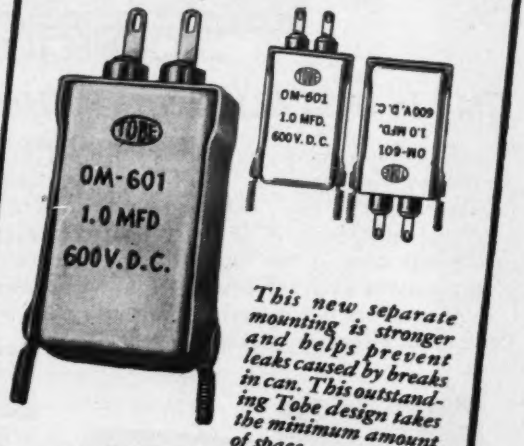
▶ HOWARD K. HALLIGAN has been elected president of the General Gas & Electric Corp., operating unit in the Associated Gas & Electric system, succeeding DENIS J. DRISCOLL, who continues as a director and member of the executive committee of General Gas and as a trustee of Associated Gas & Electric Corp. Mr. Halligan has been vice-president of the utility since 1941, and is chairman of its executive committee. He was graduated from Amherst College in 1930, and joined the staff of the trustees of Associated Gas & Electric in 1940.

▶ ARTHUR V. WILKER has been elected president of the National Carbon Co., Inc. and Canadian National Carbon Co., Ltd. He has been connected with the organization continuously since 1910 with the exception of three years as head of the department of chemistry at Baldwin Wallace College. Mr. Wilker has been responsible for production and important research work in the manufacture and use of carbon and graphite products. JOHN M. SPLANGLER, formerly a vice-president, has been appointed vice-president and general manager. Mr. Spangler joined the company in

THE **GIANT TORTOISE**, believed to outlive all vertebrae. Its usual life span is up to 100 years, but records show one to have been at last 152 years old and possibly 200.

# STANDARD OF STAMINA

What you want most in a capacitor is what you are sure of getting in TOBE Capacitors: . . . *long life!* Your proof is in Tobe's enviable record of practically no "returns". Frequent, rigid inspections eliminate uncertainty. Constant research brings constant improvement. The original capacitor with hold-down bracket, Tobe OM-601, offers many definite advantages. This capacitor is strong, compact and space-saving. The hold-down bracket permits the use of either inverted or upright terminals, with wiring underneath or on top of chassis. Write for details and samples (1.0 mfd and 2.0 mfd). Tobe engineers are glad to be of service.




*This new separate mounting is stronger and helps prevent leaks caused by breaks in can. This outstanding Tobe design takes the minimum amount of space.*

**LONG LIFE ASSURED!**

**SPECIFICATIONS TOBE OM-601 CAPACITORS**

**TYPE** . . . . . OM
**RATINGS** .05 to 2.0 mfd. 600 V. D. C.
.05 mfd. to 1.0 mfd. 1,000 V. D. C.
**STANDARD CAPACITY TOLERANCE** . . . 10%
**TEST VOLTAGE** . . . Twice D. C. rating
**GROUND TEST** . . . 2,500 Volts, D. C.
**OPERATING TEMPERATURE** . . 55°F to 185°F
**MOUNTING HOLE CENTERS** . . . . . 1½"

**SHUNT RESISTANCE**
.05 to 0.1 mfd. 20,000 megohms
.25 to 0.5 mfd. 12,000 megohms
1.0 to 2.0 mfd. 12,000 megohms
**POWER FACTOR**
At 1,000 cycles—.002 to .005
**CONTAINER SIZE**
Width ⅝", length 1 5/16", ht. 2¼"

TOBE DEUTSCHMANN CORP. TOBE CANTON · MASSACHUSETTS

*A small part in Victory Today* . . **A BIG PART IN INDUSTRY TOMORROW**

1st Dimension EXPERIENCED ENGINEERING

2nd Dimension BEST OF MATERIALS

3rd Dimension PRECISION MANUFACTURING

But There's a FOURTH Dimension: TIME!

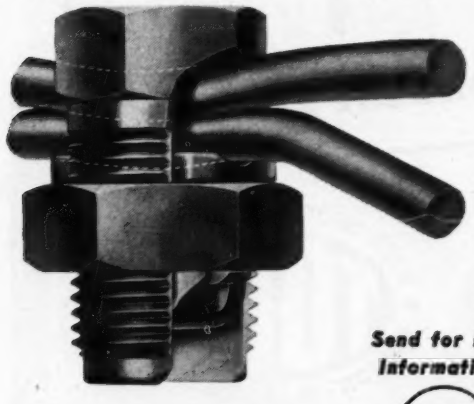
That Stands Behind

SHELDON SPLITBOLT

MAXIMUM-FRICTIONAL-EFFICIENCY SNUB-GRIP CONNECTORS

**TIME in INSTALLING**

THE U-Snub Grip on wires employed in Sheldon Split-bolts, together with the diamond-hard frictional efficiency in the threads, results not only in the highest gripping pressures ever achieved by split-bolt connectors but in saving both in TIME and effort in making installations.



**TIME in SERVICE**

THE non-loosening, vibration-proof assembly of Sheldon Split-bolts, as the result of additional, tremendous pressures obtained by diamond-hard surfaces and precision workmanship, assures a PERMANENT connection that will stand the test of TIME.

Loosening of split-bolt connections is caused by "flowing" in the conductor material and not by the nut loosening. Low pressures result in small bearing surfaces. The extremely high pressures obtainable with Sheldon Split-bolts immeasurably increase the bearing surfaces by flattening the wires against each other.

The greater the bearing surface, the greater the resistance to "flowing". Sheldon Split-bolt pressures increase contact-areas as much as five and six times, thus holding conductors together in a vise-grip that laughs at the passage of TIME.

**SHELDON Service Corporation**
**Long Island City, N. Y.**

*Send for Full Information*

*Makers of: SPLIT-BOLT and NO-BOLT Connectors; Limiters; Crab-Joints; Kompress Hydraulic Press Auxiliary Connection Blocks*

"You're Well Connected with SHELDON"

Sales Agents: We now have some excellent open territories.

1915. In 1934 he was made general sales manager and in 1940 became vice-president. W. B. PRITZ, who has been general works manager, Cleveland, was also made a vice-president in charge of manufacturing.

•

## Assistant Sales Managers Named by Kelvinator

In a move toward the post-war expansion of home office operations and executive responsibilities, Charles T. Lawson, Nash-Kelvinator vice-president in charge of the Kelvinator appliance division, has announced the appointment of three assistant general sales managers.

"Although many of our executives are spending a major portion of their time on our war production, it is not too early to start taking the steps necessary to set up the type of an organization we must have to handle the greatly increased volume of business which we expect to do in the years following the war," the announcement stated. "From these appointments will develop highly specialized and completely contained departments which will enable us to broaden and intensify our various sales activities, and, in doing so, better serve both our wholesale and retail selling organizations . . ."

E. R. Legg has been appointed assistant general sales manager in charge of the commercial and contract division. With Kelvinator since 1927, Mr. Legg has specialized for the past year in developing a comprehensive post-war program for the products of the division he now heads.

D. A. Packard is named assistant general sales manager and will be directly responsible for sales and merchandising activities on all Kelvinator household products. He has been with Kelvinator since 1940 and has served as eastern sales manager for the past few years.

T. A. Farrell has been named assistant general sales manager in charge of operations including supervision of eastern, western and Pacific Coast regional managers, as well as business operations in the home office.

•

▶ FRED H. HAGGERSON, vice-president and a director of the Union Carbide & Carbon Corp., was elected president of the corporation at a recent meeting of the board of directors, succeeding Benjamin O'Shea who has been president since 1941 and now becomes chairman of the board. Mr. Haggerson has been associated with Union Carbide & Carbon Corp. for 25 years.

▶ NELSON C. HAZELTINE has been appointed director of information for the

# WELDING CAPACITORS

*for capacitor discharge-type equipment*

- ***Uniform voltage stress***
- ***Low max. voltage gradient***
- ***Contacts SOLDERED to foil — internal arcs avoided***

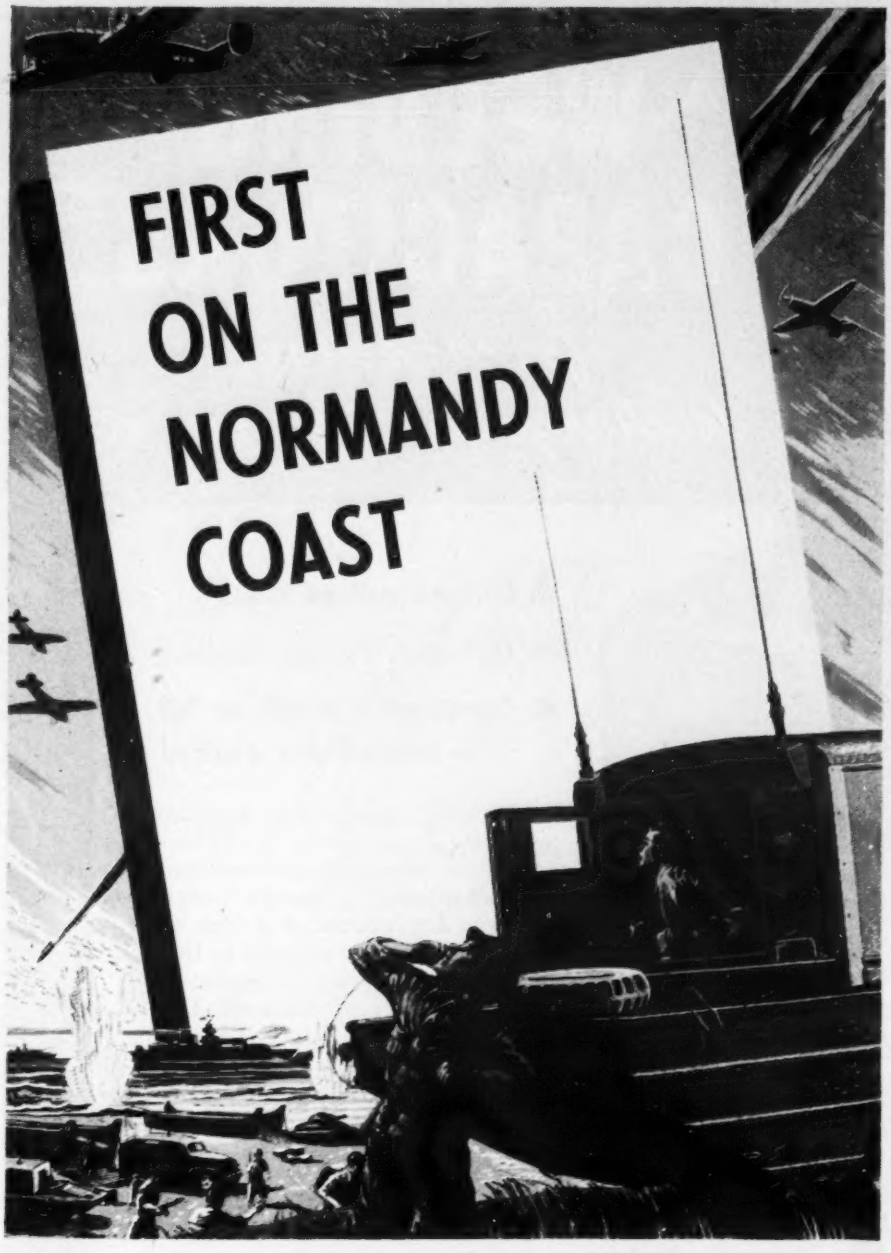
Working closely with leading welding equipment manufacturers in the rapid development of Capacitor-Discharge units, Sprague has produced a line of specially-designed capacitors that have proved eminently successful in this exacting application. The dielectric of these Sprague Welding Capacitors is a high-quality paper impregnated with an oil specially processed to assure a more nearly uniform stress throughout the units and a lower maximum voltage gradient. Longer life is the natural result. A special construction feature wherein contacts are painstakingly *soldered* to the foil minimizes danger of internal arcs with consequent gaseous discharges that might eventually ruin the capacitors.

For the latest developments in this field—whether for original capacitor-discharge welding equipment or replacement purposes—*write Sprague.*

**SPRAGUE ELECTRIC CO., North Adams, Mass.**
(Formerly Sprague Specialties Co.)

# SPRAGUE

## CAPACITORS · KOOLOHM RESISTORS




The Army's SCR-299's went ashore with the wave of Allied assault troops that split the 2nd front wide open. These mobile radio units rolled up on the beachhead early in the battle to serve as vitally important front line communications weapons to coordinate and direct striking power of the land, sea and air forces. . . . In truck or duck, the Hallicrafters-built SCR-299's go anywhere and are sturdy enough to withstand front line action. Highly dependable and powerful, they "get the message through."

hallicrafters RADIO

BUY A WAR BOND TODAY!

THE HALLICRAFTERS CO., MANUFACTURERS OF RADIO AND ELECTRONIC EQUIPMENT, CHICAGO 16, U. S. A.

Bonneville Power Administration to fill the position vacated by Henry Alderman. Mr. Hazeltine, who has been associated with trade magazines in the Portland, Ore., area, previously spent 13 years in public relations work with firms including New York Edison Co., Frank Presbrey Co. and Young & Rubicam, Inc., which handled advertising for the Tennessee Valley Authority.

**ENGINEERING HONORS**—Dr. Sanford A. Moss (right), General Electric consultant internationally celebrated for his pioneer work on airplane superchargers and a distinguished contributor to the development of compressors, steam and gas turbines, received the annual New England award of the Engineering Societies of New England, Inc., at Boston recently for his achievements and character. President Harold C. Hamilton (left) of the E.S.N.E., who is also head of the Boston Edison laboratory, made the presentation, emphasizing Dr. Moss' "exceptional service to our nation throughout a period embracing two world wars"

▶ FRANK R. DEAKINS has been made president of RCA Victor Co., Ltd., of Canada, a wholly owned subsidiary of the Radio Corp. of America. Mr. Deakins rejoins the Canadian company in which he held the position of executive vice-president from 1932 to 1934. A graduate of Alabama Polytechnic Institute, Mr. Deakins first became associated with the radio industry when he was with the General Electric Co., becoming sales manager of the radio department. He joined RCA in 1930 as assistant to the president when RCA began to manufacture its own radio and electronic equipment. He was made manager of RCA's engineering products division in 1931 and the next year

Prof. F. J. Vogel, Illinois Institute of Technology in discussing deterioration of insulation in oil immersed transformers said that it is difficult to say what level of acidity is dangerous in transformer oils. Maintenance and the use of judgment, he said, seem to be the only way to prevent trouble with acid oil. F. J. Pohnan, Commonwealth Edison Co. found it "strange" that deterioration effect of acid on solid insulation of transformers has been ignored in the past and attention restricted to the effect of acid on the oil alone. [illegible] he pointed out, [illegible]

"ELECTRICAL WORLD"
April 22nd, 1944

*To keep*

# INSULATING OIL

*free of*

# MOISTURE—AIR

*and harmful* ACIDS

# *The* BUCKEYE "HYDROVOLIFIER"

**1. A PORTABLE, COMPACT MACHINE** Permits servicing of transformers in place without service interruptions.

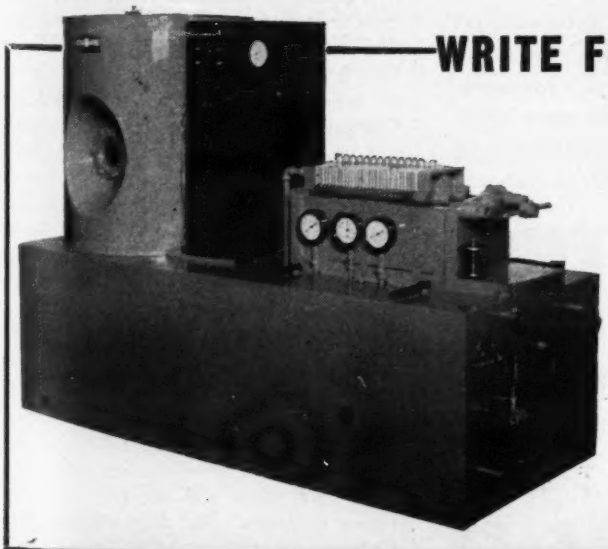
**2. LOW OPERATING COSTS** On larger models less than one cent per gallon.

**3. A CONTINUOUS PROCESS** Oil from transformer flows through Hydrovolifier is returned to transformer in a continuous circuit.

**4. SIMPLE, AUTOMATIC OPERATION** Only three connections are made in the inlet and outlet lines and power circuit. Temperatures and pressures are automatically controlled.

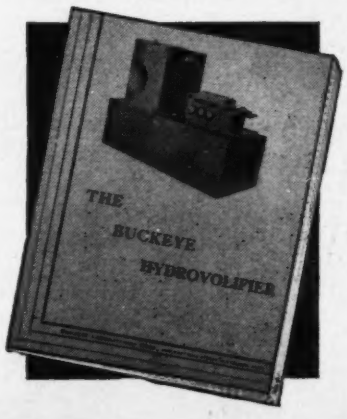
**5. LARGE CAPACITY** Three standard sizes—100 gal. per hr.—300 gal. per hr.—500 gal. per hour. Oil serviced in a single pass through the apparatus.

**6. A CLOSED SYSTEM** In the Buckeye Process oil is treated at low temperature under high vacuum. No air comes in contact with oil during processing.



## WRITE FOR HYDROVOLIFIER BULLETIN

• Contains information on factors affecting performance of insulating oils—how the Hydrovolifier works; design and construction of the apparatus. Write for your copy today.




★

**BUCKEYE LABORATORIES CORP.**

1965 EAST 66TH STREET . . . CLEVELAND 3, OHIO

**A BLAZING TRANSFORMER must be extinguished within a few seconds — before flames spread destruction through the entire installation. To make sure of immediate action, many utilities protect oil-filled equipment with a . . .**

**GRINNELL MULSIFYRE SYSTEM**

MULSIFYRE SYSTEMS operate on the principle of emulsifying blazing oil with a driving spray of water.

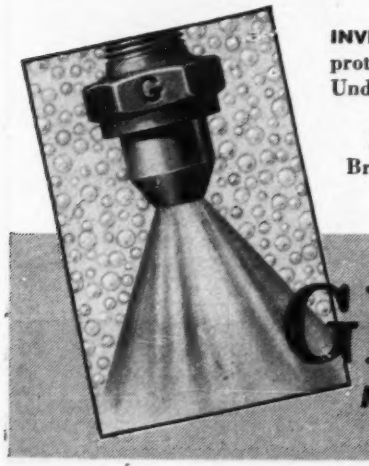
The oil is turned into a liquid which is incapable of burning. Fire is extinguished in a few seconds and reignition is prevented.

Complete separation of water and oil takes place in a few hours . . . leaves oil undamaged.

There is absolutely no conductivity along the discharge of a Mulsifyre projector when spray strikes conductors carrying high voltages.

Mulsifyre Systems are permanently installed . . . they operate automatically or manually.

Recommended by Underwriters' Laboratories for use in extinguishing fires in flammable oils immiscible with water, wherever such oil is a fire hazard – in transformers and other oil-filled electrical equipment.



**INVESTIGATE** this simple, sure oil fire protection. Write for Data Book by Underwriters' Laboratories.

Grinnell Company, Inc.,
Providence 1, Rhode Island.
Branch offices in principal cities.

**GRINNELL**
**MULSIFYRE SYSTEMS**


joined RCA Victor Limited of Canada as executive vice-president. He returned to RCA Victor, Camden, in 1934 to become manager of the special apparatus division. Since the entry of the United States into the World War, Mr. Deakins has been executive assistant to the general manager.

▶ A. G. Berggren, West Orange, N. J., and Charles D. Geer, East Orange, have been appointed vice-presidents of Thomas A. Edison, Inc. Mr. Berggren is manager of the special products division and Mr. Geer general manager of the instrument division. Mr. Berggren has been with the company 17 years and worked directly with the late Thomas A. Edison as superintendent of his laboratories. Mr. Geer conducted an engineering firm in Connecticut before joining the Edison organization eight years ago.

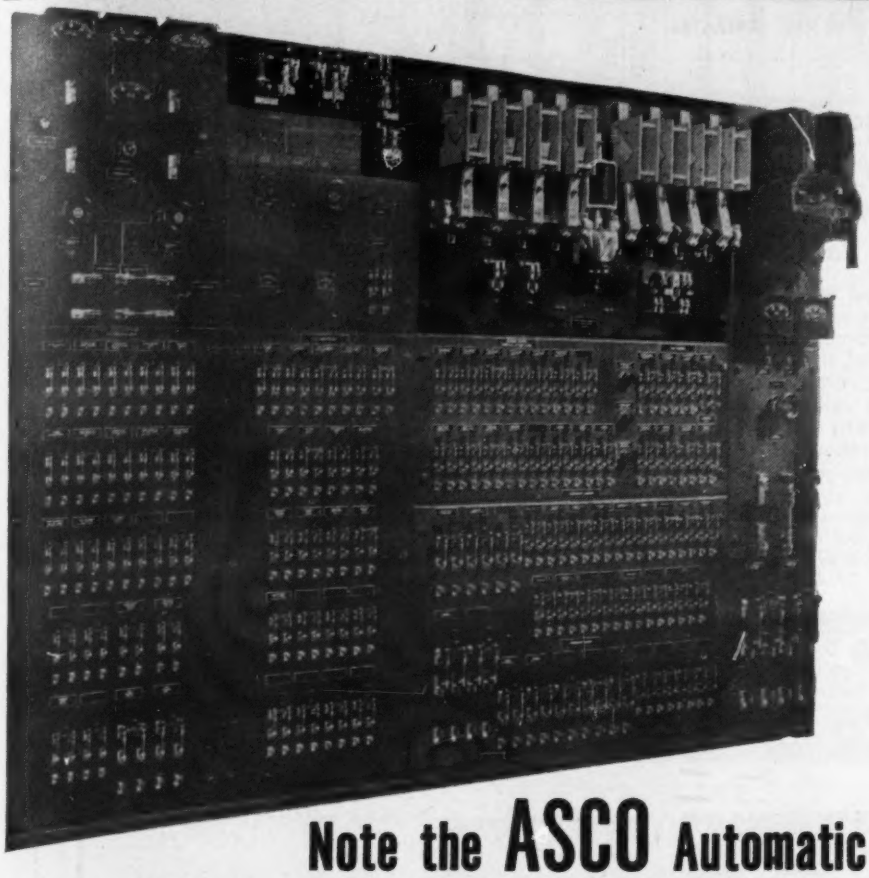
▶ William Hatton has been elected a vice-president of the International Standard Electric Corp., manufacturing affiliate of the International Telephone & Telegraph Corp. Mr. Hatton was formerly manager of the telephone division of the Federal Telephone & Radio Corp., which is a subsidiary of I.T.&T.

▶ Everett G. Agee, who for the past 15 years has served as a salesman for the midwest sales district of General Electric's lamp department, has been promoted to the position of manager of that district with headquarters at Kansas City. Mr. Agee is filling the vacancy occasioned by the death of Howard F. Viot.

▶ Walter P. Hoagland, Graybar vice-president and central district manager with headquarters in Chicago will retire from the company after 44 years of service. He will be succeeded by George J. Cossmann, formerly assistant central district manager who will take over his predecessor's duties as central district manager, which include supervision of the Chicago main house and the branch houses in Indianapolis, Grand Rapids, Milwaukee, Davenport, Hammond, Peoria and Des Moines. Both men have been continuously identified with the Graybar organization in the Chicago area since 1900. W. E. Guy becomes district commercial manager at Chicago, succeeding J. H. Gleason, who, pending his retirement in a short time will remain in an advisory capacity. Mr. Guy started with Graybar in 1924.

▶ Fred J. Wellhouse, chief of the light control section of the ninth region of the Office of Civilian Defense, has returned to his former posi-

## The Makeup of *Outstanding* Switchboards



# Note the ASCO Automatic Transfer Switch and Engine Starting Relays on this ELECTRIC SERVICE Switchboard

The switchboard illustrated is manufactured by Electric Service Control, Inc., Newark, N. J. It is designed to start an emergency Diesel upon failure of normal service and then transfer the load to the emergency source. Upon restoration of normal service the load is automatically restored to it.

This places a great responsibility upon the automatic transfer equipment to provide continuity of service to important apparatus.

That Electric Service relies upon ASCO Automatic Transfer Switches and Relays for this important application is evidence of their adaptability and reliability.

ASCO *Electrically Operated* SWITCHES include
- AUTOMATIC TRANSFER SWITCHES
- REMOTE CONTROL SWITCHES
- CONTACTORS RELAYS

We also manufacture a line of Solenoid Operated Valves for Automatic and Remote Control of Liquids and Gases

**Automatic Switch Co.**

41-C East 11th Street, New York 3, N. Y.


tion as lighting specialist in aviation, marine and street lighting fields for Westinghouse Electric & Manufacturing Co., San Francisco. Recent relaxation of dimout lighting controls in San Francisco enabled him to relinquish this work for OCD, but he will continue as light control consultant with that agency. Mr. Wellhouse has been identified with Westinghouse in San Francisco for 15 years.

► C. Swain Lumley, formerly general manager, Roller-Smith Co., Bethlehem, Pa., has rejoined the engineering staff of Smith, Hinchman, and Grylls, Inc., architects and engineers, Detroit, Mich. in the capacity of industrial engineering manager. Mr. Lumley left Detroit to become associated with the Roller-Smith Co. in 1939 as district engineer of the Midwest district, Chicago, Ill., and was transferred to Bethlehem, Pa., in 1942 as co-ordinating engineer and later appointed general manager. He has been associated with the power and consulting engineering field for the past 25 years, having started with the New York Edison Co. in 1919. He left that utility in 1926 to join the engineering department of Smith, Hinchman, and Grylls, Inc.

## OBITUARY

### Joe H. Gill

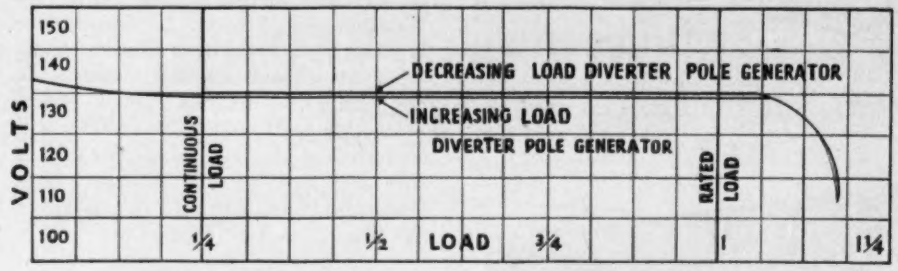
Joe H. Gill, president and chairman of the board of the Electric Power & Light Corp., and president of United Gas Corp., died on June 16 of a heart attack in New York at the age of 58. Since 1935, Mr. Gill had supervised the development and refinancing of the subsidiary companies of Electric Power & Light Corp.

Born in Kerrville, Tex., Mr. Gill received an electrical engineering degree from the University of Texas in 1910. Following graduation he began his career with the General Electric Co. in Schenectady, N. Y. After two years he became associated with the Texas Power & Light Co. in Dallas in an engineering capacity, advancing to general supervisor of design and construction of electric distribution and transmission systems. From October, 1917, to December, 1918, he was in the service of the Government and had charge of electrical design and layout of power equipment for the American Ordnance Base Depot in France.

Following military service in World War I, he became identified with the Dalas Power & Light Co., beginning as salesman and advancing to assistant general manager of design, construction and operation of the company's plants and systems.

In 1925 he went to Florida to assist

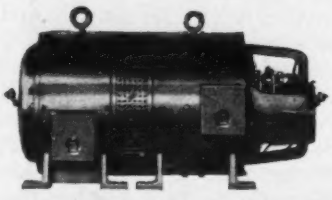
## THE DIVERTER POLE GENERATOR




(Volt-Ampere characteristics charging a 60 cell Oil Switch Battery)

### Insures Un-attended Automatic Charging For Standby and Control Batteries

With the DIVERTER POLE GENERATOR you get CONSTANT CHARGING VOLTAGE that insures:—Control of the charging voltage within very close limits—a proper trickle charge to the battery at all times, keeping it in a fully charged healthy condition—a continuous floating charge night and day—an elimination of any manual attention of the charging.



With this CONSTANT CHARGING VOLTAGE the generator carries all load within its capacity and automatically shifts all excess load onto the battery (note curve).

These advantages secured thru the inherent characteristics of the DIVERTER POLE GENERATOR greatly increases battery life and efficiency by automatic control of the voltage.

*WRITE FOR BULLETIN No. 96*
*GIVING FULL DETAILS*

**The Electric Products Co.**
**1731 CLARKSTONE ROAD · CLEVELAND 12, OHIO**

in the development and acquisition of the properties which ultimately became those of the Florida Power & Light Co. He was made vice-president of that utility in 1925 and served as its president and general manager from 1929 to 1933.

*Greystone-Stoller*

In 1933 he was brought to New York by Electric Bond & Share to act as senior operating sponsor of those utility properties in the company's system which were situated in the Southeastern area of the United States. In 1935 he became president and chairman of the board of Electric Power & Light Corp. and president of United Gas Corp.

•

► C. C. LEVY, industry engineer, metal working section, Westinghouse Electric & Manufacturing Co., East Pittsburgh, died suddenly at his home in Wilkinsburg, Pa., on June 5. Mr. Levy sponsored the application of specially designed air circuit breakers for electric arc furnace applications.

► CHARLES PERKINS ATWOOD, 89, founder and treasurer of the Atwood & Morrill Co., Salem, Mass., valve and steam specialty manufacturers, died at his home in that city on June 2. He was a native of Winterport, Me., and went to Salem as a young man.

► COL. GEORGE A. HUNT, U. S. Army Reserve officer and engineer for the Pacific Gas & Electric Co., died June 12 in Oakland, Calif, from a heart attack following an illness of several months. Colonel Hunt was P. G. & E. assistant engineer, handling matters connected with water rights and guard coordinator handling the protection of company properties at the time of his death. He started his engineering career with P. G. & E. in 1914 and attained the rank of colonel in World War 1.

ALONG THE RIGHT-OF-WAY WITH

# HIGHWAY

## HIGHWAY EARTH BORING *Machines*

★ That tomorrow for which we are all working on the home front will see methods of a modern nature adopted to greater extent than ever before. Among them will be the mechanized method for hole digging. America's hurried and successful operations in the past few years have been a great instructor in the benefits that accrue to all as we put more and more modern equipment in the hands of workers.

True, in the past, utilities have to a wide extent recognized the many advantages HIGHWAY Earth Boring Machines have offered. Thousands upon thousands of holes have been dug by this ingenious method, through frost, shale, rock, hardpan, gumbo, sand, gravel, in swamps, and on hillsides.

This organization, with more experience behind it and with even better facilities than ever before, will be at your service when that tomorrow comes to give you the most advanced method for "boring the hole and setting the pole."

**HIGHWAY TRAILER COMPANY**

MANUFACTURERS OF

TRUCK TRAILERS AND BODIES • EARTH BORING MACHINES • WINCHES • OTHER PUBLIC UTILITY EQUIPMENT

*General Offices*

**EDGERTON, WIS., U. S. A.**

# MANUFACTURING MARKETS

## Official Urges Mass Science Education

Aggressive methods for capitalizing the immense "stockpile" of scientific knowledge built up in accelerated wartime research must include a broad educational program directed to the millions of average Americans who will want and use the improved products of the future, Ernest R. Breech, president of Bendix Aviation Corp., recently stated.

"If industry is to maintain its status, reestablished in this war, as the main driving force in American life, it must take the lead in coordinating science with mass education," he said. "Grappling with the realities of a scientific war for survival," Mr. Breech pointed out, "a large segment of Americans—including millions of American men and women on the battlefront and home production front—have speedily acquired a close-up practical education in basic and even advanced sciences that were little more than words to them a few years ago.

"Their rediscovered faith in scientific progress and the immense stockpile of personal ingenuity and practical knowledge they have built up the hard way in this war constitutes one of the nation's most valuable assets in translating wartime technical advances into terms of the common good. But we must plan now to use and expand this tremendous educational force to develop a buying public keenly aware of the new opportunities that will be open."

He urged particularly a broader program of practical scientific education for youth to help prepare public understanding for the constructive use of the host of scientific innovations to come after victory.

•

## General Control Expands

General Control Co., has announced its removal to a new office and plant at 1200 Soldiers Field Road, Boston 34, Mass. This new modern building makes available many times the previous floor space. Features of the new building include an enlarged engineering department, new laboratory equipment for the developing and testing of electrical and electronic products, and an assembly hall for engineering meetings.

•

## Trumbull Forms New Southeastern District

Trumbull Electric Mfg. Co., Plainville, Conn., has established a separate southeastern district with headquarters in the Red Rock Bldg., Atlanta, Ga., under the management of H. S. Hill, for many years in charge of the Atlanta office.

Associated with him are E. E. Frost and A. T. Allison, who have been operating out of Nashville and Charlotte respectively for a number of years, and Hugh N. Delinger in New Orleans, replacing M. Turner, now located in the Cincinnati district, with headquarters at the Norwood factory.

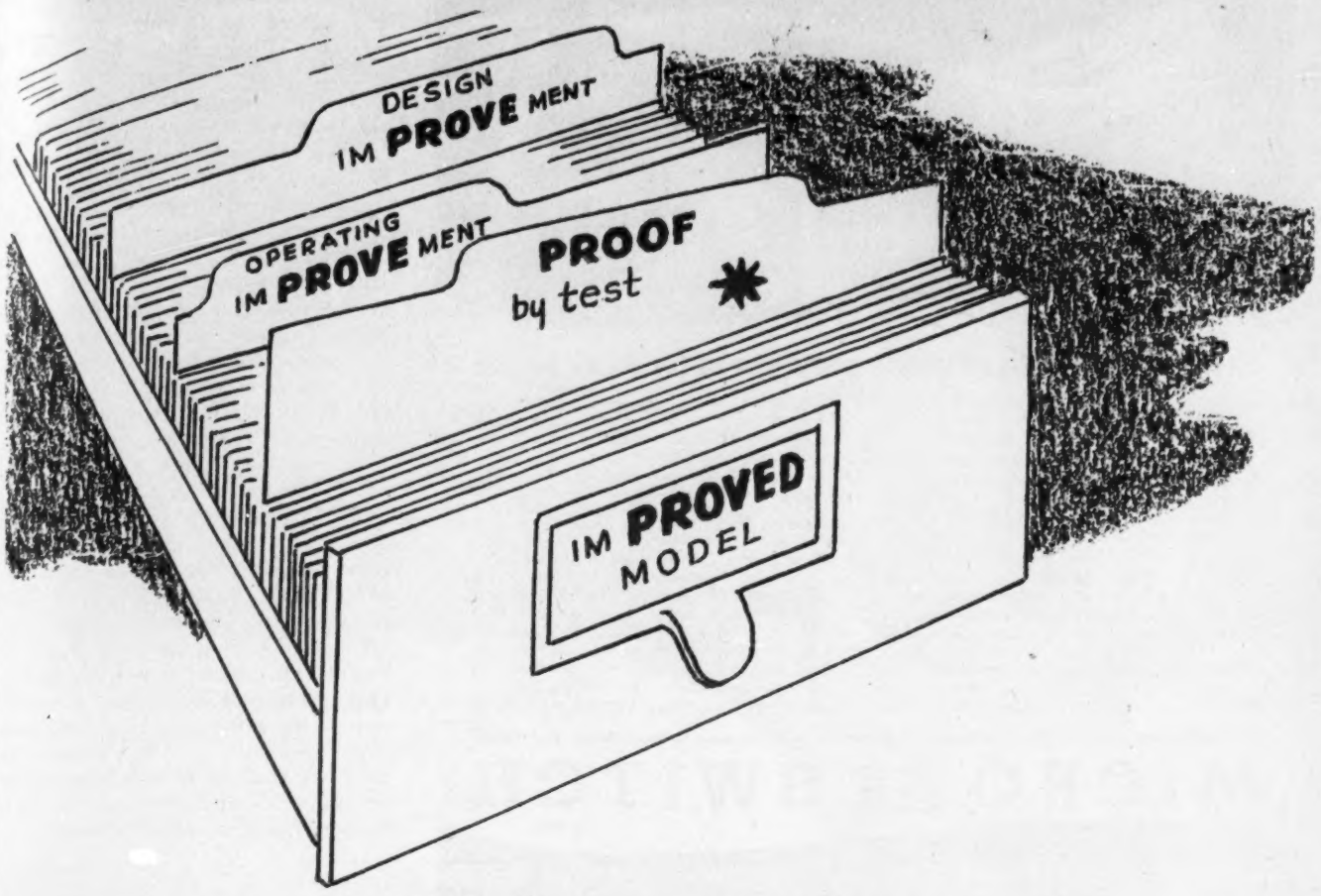
•

## Nine Companies Sued Over Navy Cable

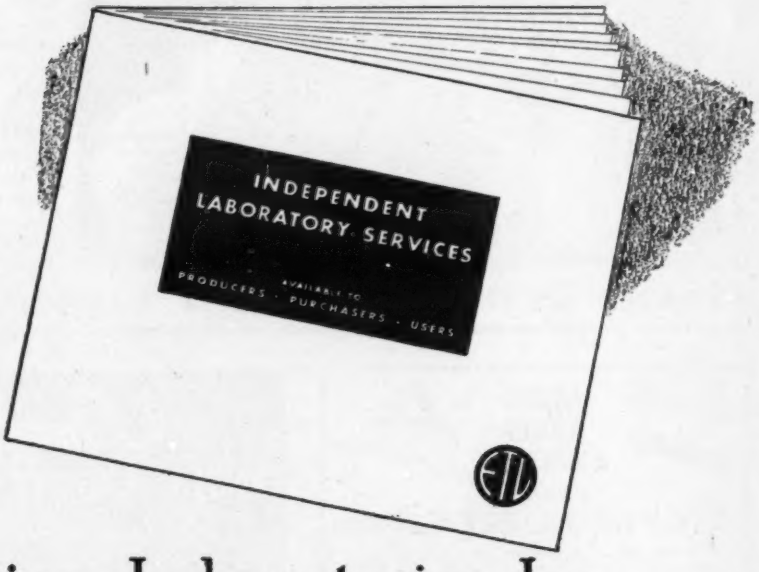
To forestall an informer suit and to protect possible government rights, United States Attorney James B. McNally has filed civil suits in the Federal Court against nine cable companies and six individuals, who, he said, submitted collusive bids in the sale of patented cable for the Navy. The government seeks to recover $2,000 damages for each sale based on alleged collusive bidding. The sales were made under approximately 365 contracts with the Navy Bureau of Supply and Accounts.

The suits are against the Rockbestos Products Corp. and Arthur G. Newton, its president; General Electric Co.; Okonite Co. and Frank C. Jones, its president; Collyer Insulated Wire Co.

**FIRST TO MEET QUOTA**—Nash-Kelvinator's Detroit plant won the honor of being the first big war plant in Michigan and one of the first in the nation to meet quota in the Fifth War Loan Drive. The plant raised $241,150, oversubscribing the $240,000 goal. Left to right: Carl Holth, head of the company's war bond department; Jack Collins, management's shop chairman; John Cieslak, "high buyer" with five $1,000 bonds; D. C. Rulo, Nash-Kelvinator's director of labor relations and Peter Rettich, president of Local 9 MESA




## ✱ marks the spot where THIS BOOKLET BELONGS!




If we are to accept the predictions of the press, many redesigned products will be offered for postwar customer acceptance.

Experience has shown that in new or revolutionized markets, many competitive products appear—few achieve long-term customer acceptance.

To assist industries seriously designing for IMPROVED service from new designs, ETL provides many services that are safeguards against factors which may militate against acceptable performance.

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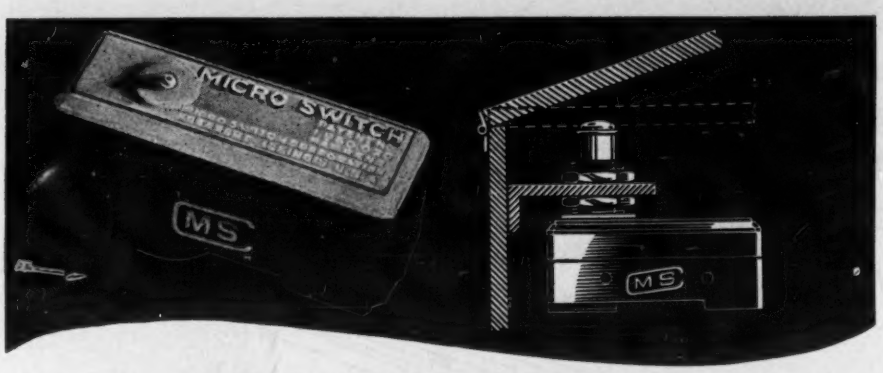


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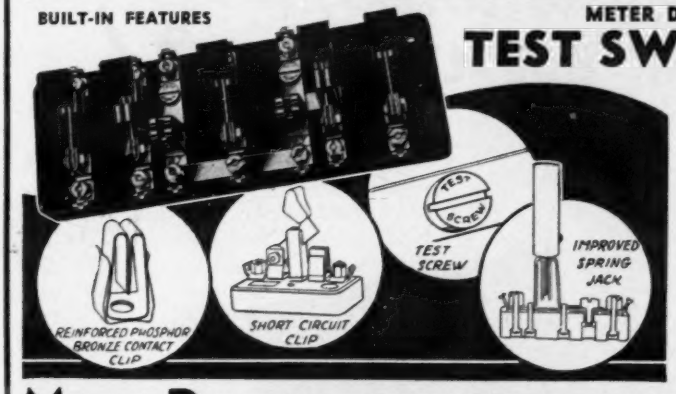
## TEST SWITCHES

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and Robert C. Moeller, its secretary-treasurer; Phelps-Dodge Copper Products Corp.; the American Steel & Wire Co. of New Jersey; General Cable Co. and Dwight R. G. Palmer, its president; National Electric Products Corp. and William C. Robinson, Sr., president; Anaconda Wire & Cable Co. and W. F. Sprackling, vice-president.

An indictment brought in 1942 against these defendants by the Criminal Division of the Department of Justice resulted in an exoneration of individuals and, without admitting liability, an acceptance by the companies to a fine of $77,500, so that they could devote their time to necessary war production without interruption.

In August, 1942, an informer suit was brought against the same defendants by Israel Beckhardt under an old statute which went back to Civil War days. Since that time Congress has amended this old statute and the present suit is brought to forestall an informer suit under the new legislation. The government states that it intends soon to file a formal motion for a stay of the Beckhardt suit. In the meantime the Civil Division is understood to be reviewing the whole situation to determine its rights to obtain recovery.

•

## Oliver to Modernize Pennsylvania Plant

To fill a big Army shell contract, Oliver Iron & Steel Corp. has announced plans to modernize the Garland Manufacturing Co. plant in West Pittsburg, Pa., near New Castle.

Ernest Schleusener, vice-president in charge of Oliver operations, said more than $1,000,000 in government-financed machinery will be installed in the plant. Nearly 400 men and women will be employed.

•

## Storage Battery Sales

Sales of electric storage batteries and parts by principal Canadian producers were valued at $2,478,000 during the first quarter of 1944 as compared with $2,426,000 in the previous three months and with $1,959,000 in the first quarter of 1943.

•

## Line Material Net Up

For the quarter ended March 31, the Line Material Co. and domestic subsidiaries reports net income of $450,827, or $1.06 a share, compared with $176,016, or 41 cents a share for the corresponding period last year.

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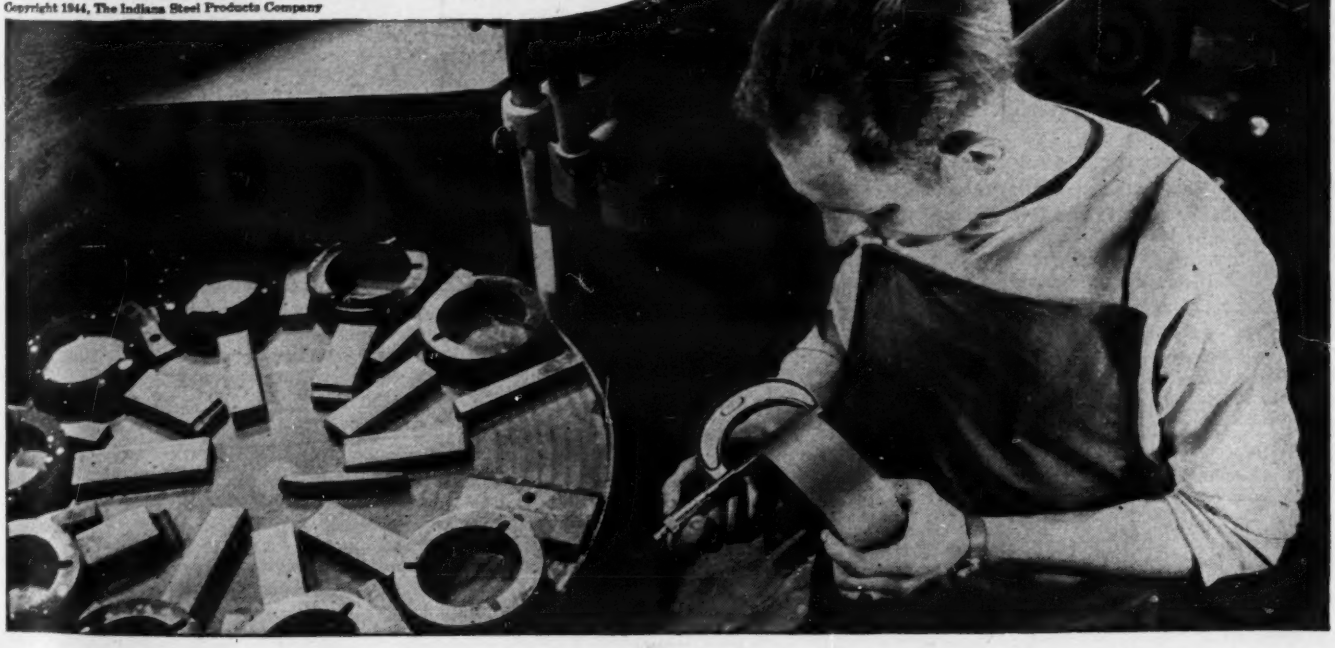

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# Field Reports on Business

*Navy requirements are calling for a large quantity and wide variety of electrical equipment. Rubber products are in strong demand as are also insulating materials, lighting and wiring supplies. WPB-approved line extensions and substation construction projects are becoming more frequent as government restrictions are liberalized*

## CHICAGO

Reports of WPB-approved transmission line extensions and substation construction projects are becoming more frequent in this area as government restrictions are liberalized and long deferred system improvements are approved. The number of such projects remains small and widely scattered geographically yet the fact that they are on the increase is undeniable.

Intersate Power Co., Dubuque, last week received government approval for the construction of 16½ miles of single-circuit 69-kv. wood-pole transmission line and a 2,000-kva. terminal substation. The line is to be built for 69 kv. but will be operated initially at 33 kv. It extends from a point in south-central Minnesota south across the Iowa state line a few miles. Aluminum conductor is to be used, it is stated.

At Eau Claire, Northern States Power Co. has received a priority rating for a proposed power substation and will begin foundation and other work at once. The project will cost about $300,000.

Although major new plant construction in the Chicago area has long been past the peak, last month saw investment in industrial plant facilities expanded by $5,745,896. This brings the five month 1944 total to $42,550,746. Most of the new facilities represented additions to existing plants. There has been very little new plant construction here. Companies that have undertaken expansion during the past month include: Westinghouse Electric & Manufacturing Co., Russell Electric, Bastian-Blessing, Drake Electric and others.

## PACIFIC COAST

San Francisco is almost abreast of New York as the major port of embarkation and according to Army officials, may even double its volume as Pacific drive reaches its peak. This is reflected electrically in such typical items as a 600-kw. increased load, mainly for lighting, in a nearby Naval Ammunition Depot, with a 2,000-kw. temporary load for dredging; and the conversion of a concrete shipyard to a repair yard with floating docks means 3,000-kw. additional load and comparable electrical equipment. The million dollar four 50-kw. transmitter station in Solano County, Calif., ready in October, is first of several similar stations OWI is installing along the Pacific Coast. Total value of May building permits for the seven western states equalled the May 1943 value, with California, which furnishes 80 percent of the total, running on an even keel, the Interior States averaging 250 percent over last year, and the Pacific Northwest about 30 percent less. Westinghouse bid of $32,690 was low on telemetering equipment for eight substations of Bonneville and Grand Coulee systems.

Navy is buying $314,000 of portal cranes for Coronado. Priority has been granted D.&R.G. railroad for $50,000 of floodlighting material for its Salt Lake City and Minturn yard systems. Naval Air Station in Washington has been awarded $58,000 for field lighting, typical of many similar installations now being made in the west. Mare Island is rewiring its Naval ammunition depot.

Other orders include 550 motors, sizes 1½ to 5 hp. to a manufacturer of pumping plants; a $60,000 central stock shipment of medium size transformers to a public utility; and $45,000 offswitch gear and regulating equipment to city of Alameda.

## NEW ENGLAND

Industrial activity in this area continues near the high war time level. DFC allocations for the purchase of additional equipment recently announced include $300,000 for an addition to Monsanto Chemical Co.'s Indian Orchard (Mass.) plant and $430,000 to the Atlantic Tubing & Rubber Co., Bellefont, R. I. President A. R. Schiller of the Public Service Co. of New Hampshire states that "the sale of electricity for use in the home is increasing at a greater rate than last year. This is in spite of the facts that new electrical appliances are not now available, old appliances are dropping out of use, and that the company and our industry have exerted real effort to cause electricity to be used sparingly because it is a resource essential to the war effort."

Navy awards of orders for electrical supplies and equipment received in this area include International Equipment Co. centrifuges; dish-washers to Colt Patent Fire Arms Mfg. Co.; General Electric plastic tubing; vacuum tube sockets to National Co., Malden, Mass.; 2,250 hand flash lights to a Connecticut plant; over $10,000 worth of copper ribbon to New England Electric Works, Lisbon, N. H., and sizable amounts of insulating materials. A Connecticut company has entered bids for furnishing electric furnace linings to the Navy.

Bidding on Navy schedules is fairly active. Rubber products are in strong demend; non-ferrous tubing bids involving more than $200,000 have been submitted by Connecticut manufacturers, and fibre conduit and mica insulating materials continue in a strong position. One order for general purpose fuses placed last week totaled more than $100,000, and a Massachusetts manufacturer submitted bids on 24 electric food conveyors.

## NEW YORK

Industrial activity is being sustained at approximately the high war time level.

Civil engineering construction volume on continental U. S. totaled $29,222,000 last week. This volume was 32 percent lower than in the preceding week, 34 percent under that reported to *Engineering News-Record* for the corresponding 1943 week, and 5 percent below the previous four-week moving average. Private construction for the week declined 61 percent from the preceding week and was 7 percent under the corresponding week last year. Public construction was 16 and 38 percent lower, respectively, than the preceding week and a year ago, due to the decrease in federal volume. The week's construction brought 1944 volume to $829,378,000 for the 24 weeks, a decrease of 52 percent from the $1,712,510,000 reported for the 1943 period.

Retail trade in the Metropolitan area, rebounded sharply last week following the mild letdown in the previous week because of the invasion. Department store volume was up 10 to 12 percent over the similar week a year ago.

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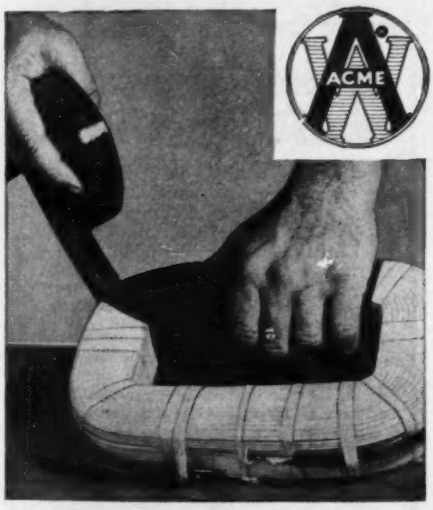


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# Sales Opportunities

OREGON—Portland General Electric Co., Portland, plans 11,000-volt submarine cable line across Willamette River, with installation of conduit on river bed. Application has been made to War Department for permission and work will be carried out as soon as authorized.

MINNESOTA—Public Utilities Commission, New Ulm, A. C. Sannwald, secretary, will receive bids until 7:30 p. m., July 6, for furnishing and installing new 6,000-kw. steam turbine-generator unit and surface condenser in municipal power plant, including complete accessories. Ralph D. Thomas & Associates, 1200 Second Ave. South, Minneapolis, are consulting engineers. Project is understood to have a priority rating.

CALIFORNIA—Bureau of Yards and Docks, Navy Department, Washington, D. C., has authorized expansion in naval air base, including hangars, shops and other buildings, with mechanical and electrical equipment. Also will make extensions in power substation facilities, electrical distribution system and service connections. Appropriation of $1,127,800 has been approved for project, which will be carried out under direction of Public Works Office, 11th Naval District, foot of Broadway, San Diego.

WISCONSIN—Water Department, Chilton, plans early call for bids for two-motor-driven pumping units, with controls and accessory equipment, in connection with extensions in municipal water system. McMahon Engineering Co., Menasha, is consulting engineer.

UTAH—Denver & Rio Grande Western R. R. Co., Third and Rio Grande Sts., Salt Lake City, plans installation of floodlighting system at local yards and shops. Also installation of similar floodlighting system at yards in Colorado. Total cost of both projects estimated at close to $50,000. A priority rating has been secured.

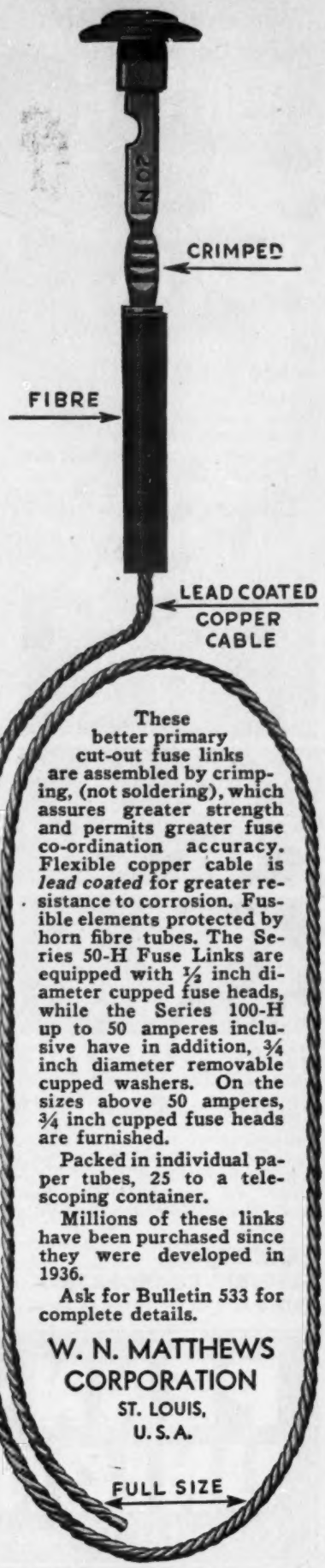
MASSACHUSETTS — Monsanto Chemical Co., Springfield, will carry out expansion in local plastic products plant for production for government, including installation of machinery and electrical equipment. Cost estimated about $400,000. Work will begin at early date. Financing by Defense Plant Corp.

ARKANSAS—Arkansas Power & Light Co., Pine Bluff, plans extensions in transmission line. Application has been made for a priority rating, with work scheduled to begin as soon as secured.

CALIFORNIA—Bureau of Yards and Docks, Navy Department, Washington, D. C., has approved plans for expansion in naval auxiliary air station including two hangars, warehouses, shops and other structures, with mechanical and electrical equipment. Extensions will be made in power substation, distribution lines, service connections and other electrical facilities. Cost estimated about $869,000. Project will be supervised by Public Works Office, 11th Naval District, foot of Broadway, San Diego.

MINNESOTA—Light and Power Department, Sleepy Eye, will receive bids until July 10, for extensions and improvements in municipal power plant, including furnishing and installing new steam-turbine


**50-H AND 100-H MATTHEWS FUSE LINKS**




These better primary cut-out fuse links are assembled by crimping, (not soldering), which assures greater strength and permits greater fuse co-ordination accuracy. Flexible copper cable is *lead coated* for greater resistance to corrosion. Fusible elements protected by horn fibre tubes. The Series 50-H Fuse Links are equipped with ½ inch diameter cupped fuse heads, while the Series 100-H up to 50 amperes inclusive have in addition, ¾ inch diameter removable cupped washers. On the sizes above 50 amperes, ¾ inch cupped fuse heads are furnished.

Packed in individual paper tubes, 25 to a telescoping container.

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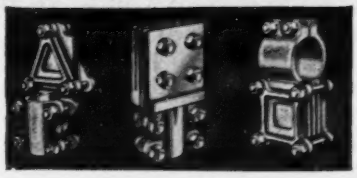

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generator unit, boiler and auxiliary equipment. Cost estimated about $200.000. It is understood that project will secure a priority rating. Ralph D. Thomas & Associates, 1200 Second Ave., South, Minneapolis, are consulting engineers.

TENNESSEE—Polar Cold Storage, Inc., Nashville, recently organized, care of Charles F. Lovell, Nashville Trust Bldg., Nashville, agent, has contracted with government for construction and operation of new cold storage and refrigerating plant on local site, for federal service. Cost estimated at $1,000,000, with mechanical and electrical equipment. Financing through Defense Plant Corp. Work will begin soon.

ARKANSAS—Light Commission, Paragould, has preliminary plans for expansion and improvements in municipal power plant as a post-war project, including installation of additional equipment. Cost reported in excess of $100,000. Also will make extensions in electrical distribution lines and service facilities.

WASHINGTON—Bonneville Power Administration, Department of Interior, Portland, Ore., plans construction of overhead transmission line across Snake River, consisting of two 110,000-volt lines, with minimum clearance of 108 ft. above low water. Application for permission has been made to War Department.

OREGON—Chapman Mfg. Co., Corvallis, manufacturer of plastic products, is considering installation of a hydroelectric power plant for power supply for new one-story factory, 100 x 200 ft., on which superstructure will begin soon. Entire project is reported to cost approximately $275,000, with mechanical and electrical equipment.

TEXAS—U. S. District Engineer Office, Fort Sam Houston, San Antonio, has plans under way for expansion in army base, including several new buildings, with underground electrical distribution system, obstacle lighting installation, power substation extensions and other electrical facilities. Proposed to ask bids soon. Estimates of cost are being made.

NORTH CAROLINA—National Carbon Co., Carbon Products Division, Chatham Rd., Winston-Salem, manufacturer of carbon and graphite products, will carry out further expansion in local plant, where work has been in progress on new additions for several months. Several new buildings will be erected, with installation of mechanical and electrical equipment. Cost reported over $500,000. Plant is being operated for government account and project has a priority rating. Main offices of company are at 30 East 42d St., New York, N. Y.

MISSOURI—Board of Public Service, City Hall, St. Louis, is arranging fund of about $2,200,000 for expansion and improvements in fire and police telephone and telegraph systems, including large new central station for operation and control. Also plans installation of motor-driven pumping machinery, controls and auxiliary equipment in connection with proposed extensions and improvements in municipal water system, entire project estimated to cost $7,500,000. A special election is planned August 1, to approve bonds for $43,527,000 for expansion noted and other improvements.

INDIANA—General Motors Corp., Detroit, Mich., has contracted with government for early expansion in plant, including additional building, with machinery and electrical equipment. Cost about $700,000 with financing by Defense Plant Corp.

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## Recent Rate Changes

OKLAHOMA GAS & ELECTRIC CO.'s reduction in residential rates, amounting to $33,000 annually in Fort Smith and Winslow, Ark., has been approved by the Arkansas Department of Public Utilities.

CLEVELAND CITY COUNCIL has passed an ordinance, effective July 7, when the present four-year agreement with the Cleveland Electric Illuminating Co. expires, providing for a reduction of approximately $1,200,000 annually for domestic consumers. In an ad appearing in local papers a statement signed by Eben G. Crawford, president of the utility, said: "The company cannot accept this ordinance, and will appeal from it to the Public Utilities Commission of Ohio. If our country were not at war, we would be well justified in seeking a rate increase. However, to eliminate a costly controversy at this time when all energies should be united to back our fighting forces, we are willing to continue the present rates for another year."

ALABAMA POWER CO. has been ordered by the state Public Service Commission to reduce its commercial rates $318,000 a year. The reduction, which will become effective July 1, will amount to slightly more than 9 percent of the 1943 commercial charges made by the company. The new rate schedule makes no change in the first bracket or minimum charge. Both the new and the old rates call for a $1 charge for the first 20 kw.-hr. The new rates fix 3½ cents per kilowatt-hour for the next 100 kw.-hr.; 3 cents for the next 280 kw.-hr.; 2 cents for the next 900 kw.-hr. and one cent per kilowatt-hour for all over 1,300 kw.-hr. After prescribing $1 for the first 20 kw.-hr., the old rates provided that 3½ cents per kilowatt-hour be charged for the next 730 kw.-hr.; 2½ cents per kilowatt-hour for the next 4,250 kw.-hr. and 2 cents per kilowatt-hour for all over 5,000 kw.-hr.

PUGET SOUND POWER & LIGHT CO. will adopt on July 1 a new wholesale rate schedule, which will result in an annual saving of $54,000 to municipalities, public utility districts, rural cooperatives, and other public bodies purchasing power for resale. The new schedule is based on a contract period of five years.

NEW YORK STATE ELECTRIC & GAS CORP. has made a revision in the rates for electric service, which will result in annual savings of approximately $224,200 to the company's customers. The new rates became effective June 19.

MARYLAND PUBLIC SERVICE COMMISSION opened hearings on June 6 on the rate structure of the Consolidated Gas Electric Light & Power Co. of Baltimore.

SHAWINIGAN WATER & POWER CO. and the QUEBEC POWER CO. have reduced their electric rates, effective June 15, according to an announcement by the Quebec Public Service Board. The Shawinigan utility has reduced its rates for all districts served by the company for three classes of service—domestic, commercial and small power consumers. Quebec Power Co. has both lowered its rates in four classes of service and in addition, introduced the practice of uniformity in rates. The Board has estimated that savings effected by these cuts will amount to approximately $1,000,000 a year.

FENNIMORE, WIS., municipal electric utility, has put into operation a reduction in rates that will save its customers $2,200 annually.


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# LETTER TO THE EDITOR

## Fault Current Polarities Compared

*To the Editor of* ELECTRICAL WORLD:

Reference is made to the article on pages 84 and 85 of the April 15 issue of ELECTRICAL WORLD. In Fig. 2 showing oscillograms of carrier pilot relay scheme in action, a correction should be made on the two traces at the very top.

In relettering for better legibility the arrows for the line designations were reversed. The arrows should point to the traces immediately adjacent to the lettering. Correct top trace is thus "Polarity checking relay contacts" and bottom trace is "Fault detector relay contacts". Similarly, the arrows for "Closed" should point to the extreme right ends of the long straight traces instead of to the short traces at the extreme right.

J. T. Logan,
Operating Engineer,
Georgia Power Co.
Atlanta, Ga.

•

## American Import-Export Board of Trade Urged

Organization of a non-partisan Import-Export Board of Trade to solve post-war problems of international commerce was recommended recently by William E. Knox, general manager of the Westinghouse Electric International Co., in a speech to the Export Managers' Club in New York. The personnel of the proposed board should include responsible representatives of Congress, the executive agencies of government, agriculture, banking, industry, labor, exporters and importers, Mr. Knox said.

Other countries certainly will want American goods after the war, but the big question, according to Mr. Knox, is how and in what manner are they going to pay for them. "They all want American machinery and methods and we want them to have it," Mr. Knox said. "How can it be done? An American Import-Export Board of Trade, an organization that will represent the over-all United States interests—not partisan, not riding any cause, but a clearing house where all related facts and factors and plans and schemes for foreign trade will be judged with intelligence and initiative, investigated, considered, and if approved, implemented."

# SEARCHLIGHT SECTION

*(Classified Advertising)*

*Continued on pages 188-189*

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(Continued on page 188)

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(Continued from page 187)

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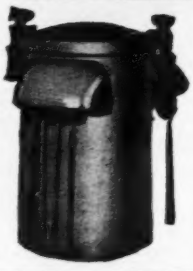

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(Continued from page 187)

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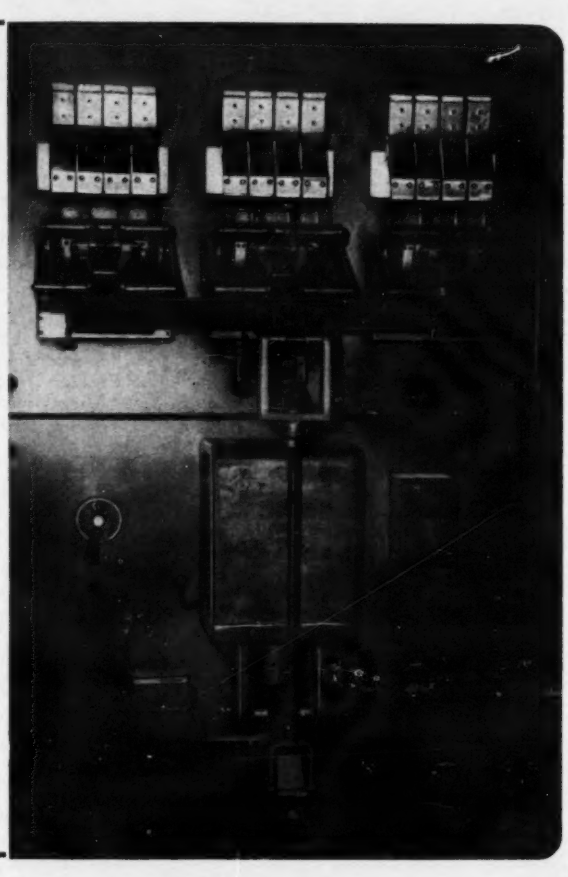

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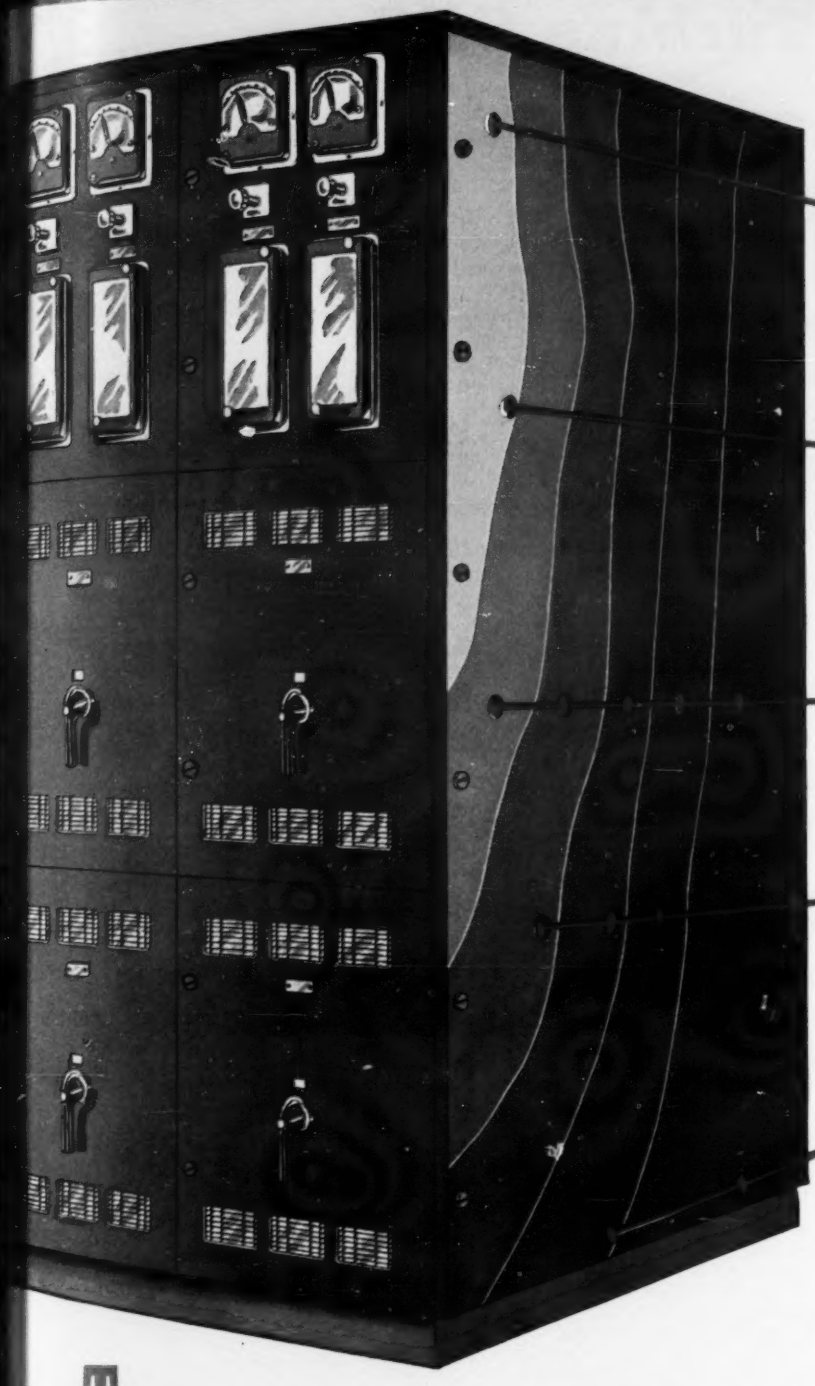
★ **These companies have supplied additional buying information on their products in the 1944 edition of the Electrical Buyers' Reference**

# ALL THIS EXTRA SURFACE PROTECTION

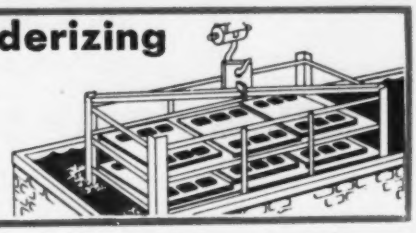
*without added cost to you . . . in*

## I-T-E DRAWOUT SWITCHGEAR

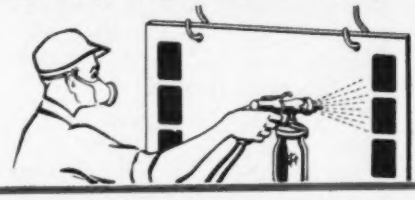


**3 Cleaning Operations**

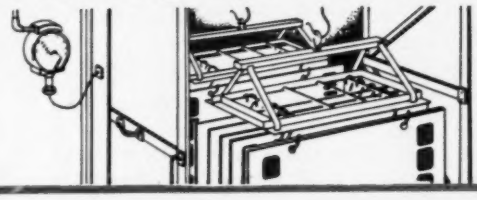
**Bonderizing**



**5 Spraying Operations**



**4 Baking Operations**



**2 Mechanical Rubbing Operations**

The extra work that I-T-E puts into the finish of a Multumite structure is in the user's interest. Electrically and mechanically I-T-E switchgear is built to serve for years and the finish is in keeping. Your first gain is in maintaining a clean structure. Your second is preservation of the metal. The third—and not the least important—is that after years of use your Multumites will look their part as dependable servants and will continue to earn your respect.

I-T-E employs the best of modern materials and practices. Processing has been standardized in our plant so that finishing operations do not penalize delivery. Equipment and skills combine to give you a definitely superior finish without added charge.

I-T-E engineers will gladly go into all details of Multumite design, operation and construction. Ask the I-T-E representative nearest you or write to I-T-E Circuit Breaker Company, 19th and Hamilton Streets, Philadelphia 30, Pa.

*Representatives in Principal Cities*

**I-T-E** *AIR SWITCHGEAR*

# What do you want to know about Turbine Oil?

Recently a number of utility plant men were asked, "What do you want to know about turbine oil?" Several of them had very specific questions. They are answered here because they may help you in selecting a turbine oil that solves, once and for all, the ever present problem of turbine oil maintenance. One question is taken up each month, but you can get the answers to all of them now—see the booklet offer.

## 4. How does a guaranteed turbine oil protect the user?

That question, of course, means Nonpareil Turbine Oil—the only oil with a written guarantee that it will "last as long as your turbine."

There is nothing unusual about a turbine oil lasting several years if the operator takes the time and trouble to keep it clean and free from excessive acidity. It *is* unusual, however, when a turbine oil lasts indefinitely and does so without sweetening or treating to reduce acidity and without cleaning the oil or turbine to eliminate deposits.

It is *most* unusual when these conditions of operation are assured by a *written guarantee* that the oil will not increase in acidity to the point where it will need treating or changing. This guarantee, quoted in detail below, is given with every fill of Nonpareil under the reasonable conditions stated.

What does this guarantee mean? First, it is a *written* guarantee—not merely a verbal promise made by a representative. Back of it are the years of research and laboratory work by which Standard Oil became convinced that it could afford to stake its reputation, and risk an enormous loss on thousands of gallons of guaranteed oil, if it did not last indefinitely. The guarantee means that you are investing a comparatively small amount in turbine oil with little or no possibility of losing anything.

Today, over 650 turbine operating records, extending over the past 17 years, prove that Nonpareil lives up to every claim made for it—that it will eliminate turbine oil maintenance and turbine deposits. The guarantee is your assurance that you will get this same trouble-free operation.

Every fill of Nonpareil is checked semi-annually by our laboratory for acidity, color, and contaminants—another indication of the responsibility and interest we have in Nonpareil in service. This inspection acts as a check on the functioning of the inhibitor in the oil and answers a question frequently raised about the lasting qualities of the inhibitor. This question will be discussed in this space next month.

### Nonpareil Turbine Oil Guarantee

"We guarantee that Nonpareil Turbine Oil, Medium and Heavy *will last as long as your turbine* where the lubrication system is thoroughly cleaned before this oil is put into use and where Nonpareil Turbine Oil, Medium or Heavy only, is used for replenishment, and where the temperature of the oil from the bearings is kept below 170° F. *This guarantee has no time limit.* If at any time, when the oil is operating under the above conditions, the neutralization number should rise higher than the extremely low limit of 0.15 when determined by A.S.T.M. Method D188-27T, we will cheerfully replace the oil without additional expense."

*Gasoline Powers the Attack . . .*
*Don't Waste a Drop!*

**For all the answers send for this booklet**...it contains answers to questions such as these:

1. What causes turbine oil deposits or sludge?
2. What causes acidity increase in turbine oil?
3. What is an oxidation inhibitor—how does it prevent acidity?
4. How does a guaranteed turbine oil protect the user?
5. Does the inhibitor in Nonpareil Turbine Oil wear out?
6. What causes corrosion in turbines?

Send for a copy of this booklet, or better still, ask for a Standard Lubrication Engineer. He can answer your specific questions about Nonpareil Turbine Oil. Write Standard Oil Company (Indiana), Room 1223, 910 S. Michigan Ave., Chicago 80, Ill., for a copy of the booklet, or the Engineer nearest you.

**NONPAREIL TURBINE OIL**

(3)

**STANDARD OIL COMPANY (INDIANA)** STANDARD SERVICE

★ LUBRICATION ENGINEERING